THE SURVEYOR, ENGINEER, AND ARCHITECT;

OR

LONDON MONTHLY JOURNAL OF THE PHYSICAL AND PRACTICAL SCIENCES

IN ALL THEIR DEPARTMENTS.

BY A COMMITTEE OF PRACTICAL SURVEYORS, ENGINEERS, AND ARCHITECTS, OF MUCH EXPERIENCE AND IN ACTIVE EMPLOYMENT.

ROBERT MUDIE, LITERARY CONDUCTOR.

PECULIARITIES OF THE ENGINEERING ARTS IN BRITAIN.

In a former number, when noticing the College for Civil Engineers, we incidentally mentioned the very marked distinction between the relations in which engineers stand to the people of Britain, and of the continental nations, where the power of the government is greater, and has more of the despotic character in it; and, as the subject is one of some importance, we now revert to it. With its politics, as bearing upon the general relations of the governors and the governed, with regard to the greater or less happiness and stimulus to activity on the part of the latter, we have no immediate concern; but, as far as regards the engineering professions, which are within our legitimate province, we consider it as being equally fair and useful.

Now, the grand difference in relation to which we allude consists in the fact of the engineering profession, in as far as civil engineering is concerned, being an emanation from the people, called forth into operation as the general state of business and the progress of improvement require; whereas in most foreign countries, especially those belonging to what are called the great powers of continental Europe, the engineering professions are, in their origin at least, an emanation from the government, called forth at its pleasure, and chiefly depending on it for its support. This is the essential distinction; but it must be received with some limitations, because there is some foreign employment of men of this profession by the people, as well as some civil engineering originating with, and paid for by, the British government. But, making allowance for this matter, and the allowance so required to be made amounts to a very small fraction of the whole, the distinction is as has been stated.

In this case too the cause is as obvious as the effect. Foreign states, being exposed to land invasion, required a great deal more fortifying and military engineering of every kind than the British islands, whose defence is in the sea, and which therefore, with a properly equipped fleet and due watchfulness, cannot be approached under cover, as a fortified place may be. This was the real origin of engineering in France, for instance; and in whatever arts the engineers were instructed, and whatever the works they executed, all was for the purposes of war much more than for those of peace. Highways and bridges were no doubt constructed, some of them on a magnificent scale; but still the accommodation of the public and the promotion of commerce was not the primary object.

So also, when engineering or polytechnic schools were formed, they were formed by the rulers, not for civil but for military engineering; and this state of things continued, in most of the countries alluded to, up to a time comparatively recent. But after the downfall of Napoleon, and the general pacification of central Europe, which speedily followed, the governments alluded to, stimulated in all probability by the example of England, began to turn their attention more to civil engineering, for the purpose of giving accommodation to trade and intercourse, in the ultimate hope, no doubt, of replenishing their own exchequers, which the general and long protracted war had exhausted. But although these circumstances have changed the occupations of the engineers, they have not changed either the system of their education or their chief employers. They are still, in a great measure, government corps, and as such there is unity among them. Several important works have no doubt been undertaken by individuals and by companies; and this is increasing; but still it is the exception and not the rule.

In Britain the case is widely different; for civil engineers were originally, and are chiefly still, an emanation from the public, that is, from parties who employ the engineers for their own pleasure or profit; and the consequence is that, instead of being a sort of united corps, like the continental ones, chiefly employed by the governments, they follow the common law of British society, in attending first and chiefly to their own interests; and, though we do not say there is necessarily any direct hostility among them, the manner in which they are employed and paid has a tendency at least to provoke a little jealousy. In some respects this is a disadvantage as compared with the continentals. It has a tendency to produce or give a bias to the wrong kind of emulation. Among men of all classes and professions there are two descriptions of this, the one professional and the other pecuniary,—the first having for his object the execution of what he has to do in the very best manner; the chief object of the second being to get the job. Engineering is not the only profession in England which suffers in its real advancement from this kind of emulation, and probably there are other professions which suffer much more, but even it suffers considerably. It is however part and parcel of the very structure of British society, and therefore we do not believe it could be remedied without remodelling the whole; and this is not possible, and perhaps would be an evil if it were.

There is another cause which does considerable injury to the engineering arts, both in the planning and the execution of public works. As these are for the most part private speculations, undertaken not so much with a view to the real service which they are to render as to the hope of gain on the part of those with whom they originate, and who, in the majority of cases, know little about the usefulness of the works, and less about the manner in which they should be executed.

In addition to all this, there are periodical manias for engineering projects, in like manner as there are similar manias in overtrading or excessive credit. Thus there is an opportunity for general jobbing; and as no company or individual can execute a work which is to interfere largely with the property of others, without the sanction of an act of Parliament, the jobbing mania is apt to assume a very malignant type.

Canals and railways may be adduced as instances of this. The ones first constructed were called for by necessity, and, therefore, they were very profitable speculations. When this became well known, men of a speculative temper were "canal bitten;" every one would have a canal; and the result has been that many of them have not paid a shilling of the original cost, and some are going to ruin for want of funds to pay repairs; and, strange though it may seem, we have seen at least one for which a single drop of water could not be obtained, except what fell from the clouds, unless it had been brought from a considerable distance, and raised to the height of several hundred feet. We are not aware that any of these canals were speculators' jobs, without any view to future usefulness or skilful execution; but some of them are of so little use, and so bunglingly engineered, that the parties with whom they originated could have had no claim to absolute wisdom; and the result has been that, except in places where there is great transit of goods, and which are favourable in a physical point of view, canals have ceased to be objects of speculation.

The railway mania being of more recent date, and a work of this kind being a greater novelty, the circumstances of that mania are better understood, as being more fully recorded and fresher in the memory. It will, perhaps, be borne in mind that the amended or enlarged estimate with which the projectors of the London and Birmingham line came before parliament was £1,200,000. We ourselves made a fraction of a party appointed to sift it thoroughly in order to ground an opposition; and that party, after estimating every item, brought the cost of the line and its establishment to within a trifle of £7,000,000: more than £6,000,000 has, we believe, been already expended, and some parts are not yet in the condition that they ought to be. The Greenwich railway, which strides from London bridge to its other terminus like a *pons asinorum* of countless arches, is another "untoward" speculation. The Eastern Counties Railway, however, seems to be the *chef-d'œuvre* of this species of

projecting, planning, and executing. To it we purpose to devote a short separate article; but, in the mean time, we may notice the fundamental objection to it *in limine*. It really leads to nothing; and so reminds one of Paddy's rope, which "he never could haul in, because somebody had—cut off the other end of it."

Now, we would ask, what is the cause, or what are the causes, of all this? They are as plenty as blackberries, but we shall content ourselves with noticing one or two of such as are most prominent. In the first place, many of these concerns were brought out by mere jobbers, parliamentary agents, attornies, projectors, and others, parties who are always endeavouring to trouble the waters, in order that they may fish more successfully; but who, at the same time, care nothing about the utility of the project, or even the carrying of it into execution. They vamp up a court of directors consisting of men according to their own heart, puff the project by every possible means, and catch subscribers, which is not so difficult a matter as might be supposed; when the requisite amount is subscribed they obtain an act of parliament,—for which there are always ways and means if there is money. The projectors get their fees, and the directors their salaries, and, at the same time, reserve numbers of shares which they contrive to appropriate to themselves, either at nothing or at very small price. In the case of railways the plans and specifications have, of course, to be laid before the house; and the former have been, at least in some instances, founded upon surveys very badly executed, the object having been to obtain them cheap. The estimates have, in most instances, been much too low; but this was advantageous to the projectors and their co-operators, because it enabled them to go again to parliament, and get well paid for their own blunder. After all this is done,—we are speaking generally of speculations having an origin like this—the parties puff the plan till the prices of the shares are as high as possible, and then they sell out; but, when they have learned the art of varying the prices to their own interest, many of them continue to job in the purchase and sale of shares. This is but a slight outline of the practice; but it would not be difficult to point out parties who have amassed a good deal of money by it, although not worth one stiver at the commencement, or being very capable of earning one in any open or honourable way. Yet, while they have done this, the speculations have, in many instances, been so badly managed as that the loss to the bona fide shareholders has been a hundred-fold greater than the sums with which the original parties made their escape. Such is the unclean thing with which the engineering arts, or rather a set of "men to be let," calling themselves engineers, have, occasionally at least, come in contact. We do not say or suppose that any engineer of talent and character has suffered himself to be polluted by such a contact; but, it is impossible that such proceedings should not have lowered the professions in the eyes of the public; and this, and not the characters or qualifications of individuals, is the point to which we must call attention, as being injurious to the most useful professions in the country.

In the second place, these projects, coming periodically with the visitations of mania, and giving no signs of their coming, and requiring the preliminary operations to be performed, quickly call into notice, and indeed into existence, whole droves of pseudo surveyors and engineers, who have no skill in the principles of their craft and no experience in the practice. These are only ephemeral, no doubt; but the mischief is done before their little day is over. We could easily extend the enumeration, but what we have given appears to be enough for the rest of the world, and may be thought too much both by those who caused and those who have undergone the suffering.

This is the grand evil to which the system of engineering of Britain is exposed; but, as we have already said, it is part and parcel of that of the country, and, as such, seems to admit of no remedy.

It must be perfectly evident that no set of men so individualized could by possibility be educated at any one general and systematic institution, let its quality be what it might. Of this we have corroborative evidence in every trade and profession connected with the industral arts in this country, no one member of which ever was taught his trade or profession at school, or at any establishment for education whatsoever. For the three professions of divinity, physic, and law, there are indeed regular institutions; and a due attendance at some one of these institutions, together with the requisite portion of private study, appears to be quite sufficient for the first of these three. But this profession is different from all others, inasmuch as the principles upon which it rests are matters of revelation, which cannot be advanced by any human experiment; and therefore no argument respecting the best mode of obtaining any one kind of merely human knowledge can be grounded upon it. Hence the mere college education is not sufficient in the other two professions; for, if a legal man had nothing but a college education, nobody would entrust him with a cause or a brief; and, if a medical man had nothing but college knowledge, he would have difficulty in getting a patient, and still more so in keeping that patient on this side the grave, if the disease happened to be one of imminent danger.

But these professions may be said to lie in a nutshell as compared with the engineering professions; and it is a sound maxim in education that the more technical any one occupation is, there is the more necessity for learning it under the superintendence of those who are in the daily practice of it. Farther than this, the extension of civil engineering does not depend upon professional engineers—far less can it depend upon mere scholastic professions. Its extensions are the results of popular demand, arising from the advancement of the sciences and arts generally, and from the increasing intelligence and wealth of the people. In consequence of this it may be said to be, at least in some of its parts, new every day, and therefore no scholastic professor could by possibility keep up with the practice. We have an example, a good deal in point, in professorships of agriculture; for however learnedly and pleasingly the professor may descant in his prelections, he invariably fails when he becomes a practical farmer.

We have now, we trust, gone at sufficient length to show the difference between the positions of Continental and British Engineers, in a way sufficient to remove the objections of those friends—some of them men of eminent talent, who have objected to our doctrine. Continental Engineering is a sort of Government Establishment. British Engineering has originated in the people; and, jobbing apart, it is regulated by their wants and wishes.

ARCHITECTURAL REPUTATIONS.

Proverbially capricious as it is, public taste is sometimes wonderfully good-natured, and never more so than in matters of architecture, where it is willing to accept plagiarism—often the dullest kind of it—as evidence of original genius and mastery. Its excessive good nature in this respect is apt, however, sometimes to prove fatal to those who profit by it; that is, as far as their ultimate reputation is concerned. There is always danger of public favour spoiling those upon whom it comes suddenly and abundantly, and with little exertion on their part, if merely because, certain of success, they relax in their efforts to merit it. Architects are seldom an exception to this; on the contrary, it generally happens that those who can best afford to devote most study to their works, and whose very selfishness, provided it contains a single spark of ambition in it, ought to prompt them to be fastidious towards themselves, in proportion as the rest of the world is indulgent, are apt to bestow the least, and finally to take up with the "That-'ll-do" system.

James Wyatt is not the only instance of a man having been ruined by being suddenly made the fashionable architect of his day. He is, however, a very notorious one; for since his death, his reputation has declined most woefully, though not more so than in proportion to his actual demerits. It may be that he did not do justice to his own talents, but suffered himself, as many others have done both before and after him, to be reduced and enervated by the *Capua* of success and popularity. We have nothing to say as to the folly or wisdom of a man's preferring *æs in presenti*, ready money celebrity, to a post obit reputation. But, if a man profess to forfeit the latter rather than give up the pecuniary advantages attending the other, he does not forfeit it the less because he does so voluntarily. Nor, having so forfeited it, ought it to be claimed for him out of any feeling of spurious tenderness. Who would have imagined fifty—nay, say forty or thirty, years ago, that *the* Wyatt would ever be stigmatized as "Wyatt of execrable memory"? Nevertheless, such are the terms in which he has been spoken of, nor has any one cared to vindicate his professional memory from the aspersion thus cast upon it: supposing it, therefore, to be unmerited, what are we

to think of those who by their silence acquiesce in it? Alas! for the celebrity of both artists and literary men when it is based upon nothing more durable than the caprice, or the "rage," as it is significantly termed, of the passing day. Even the most extraordinary degree of popularity is not always a guarantee for a man's being even so much as remembered afterwards. In proof of this we may cite the now utterly forgotten Gherardini: and who, the question will be, was Gherardini? No more now than an obscure name in a biographical dictionary; nor always, indeed, to be met with there, though in his lifetime scarcely less than idolized; and for what? Perhaps a century, hence, the same questions may be put in regard to Boz.

Fortunately or unfortunately, as the case may be, the works of architects are in no danger of becoming waste paper; but it often happens that they remain not so much for the admiration as the astonishment of posterity, who wonder how the authors of them could have obtained credit for superior talent, from their contemporaries. With respect to Wyatt, it has been recorded as something quite extraordinary that he was in the habit of sketching his designs while travelling in his post-chaise; but to us it appears still more extraordinary that he should never have bestowed farther study on the crude and hasty ideas which at first presented themselves to him. Hence both the mannerism and excessive insipidity which stamp his works; hence, too, the repetition of the same *ready-made* ideas, which, although it was at one time mistaken for fertility of imagination, is now considered to be indicative of his dearth of it.

Will it fare much better with the reputation of some others who have had opportunities of distinguishing themselves, and who have had their full share of popularity in their day? We doubt it: at all events, the celebrity of one or two of them seems to be ebbing quickly away; and, when a re-action of the sort once begins to take place, it generally goes on at a *crescendo* rate. Sir R. Smirke's fame is in this predicament, is getting "fine by degrees, and beautifully less," for, ever since Sir Edward Cust ventured to speak of the "poverty of his taste," that hint has been followed up by more explicitly stated opinions to the same effect. Among the rest, some not more severe than just remarks on Sir Robert's building occur in the July number of the Polytechnic Journal. Certain it is that no individual in the profession has been more favoured by opportunities; yet scarcely any one in it could have turned them to less account. If inspired at all, he must have been so by the goddess of dulness herself, in designing the British Museum—at least what is executed of it, King's College, the hall of the Post Office, and the centre of the river front of the Custom-house; nor need we apologize for saying so without ceremony, because we believe it to be matter of perfect indifference to Sir Robert what opinion the world may now form of his talents and his taste, he being so exquisitely Grecian as to resemble the Athenian gentleman spoken of by Horace, as—

> ——————— populi contemnere voces
> Sic solitus: populus me sibilat; at mihi plaudo
> Ipse domi, simul ac nummos contemplor in arca.

What opinion may generally be formed of his works by the architects of other countries, we are unable to say; yet his character as an artist is not very likely, we suspect, to stand very high in Germany, for we have lately met with some strictures upon his style, in Dr. Schorn's Kunstblatt, that are very far indeed from being at all complimentary. Neither is Smirke the only one who is there treated somewhat cavalierly, for we are told in the same publication, that "John Britton gilt jetzt in England fur einen arrant humbry (sic), d. h. Windbeutel." Unless "humbry" be a misprint instead of humbug, we know of no such word; but "Windbeutel" is certainly no very enviable epithet, since it means an empty gasconading pretender—one who is a mere bottleful of wind: therefore, there is little danger of B.'s tacking it to his name, except some *mauvais plaisant* should tell him it is a prodigious compliment.

Now comes our own turn; for it will no doubt be asked, what has this very rigmarole kind of article to do with architecture? The moral of it, at least, we reply, concerns architects—that is those who really wish to distinguish themselves as such, very nearly indeed. Let them not only give us originality of ideas, but let them also develop the ideas themselves, so as to impart to them their full value. Had James Wyatt been stimulated by any such ambition, fortunate would it have been both for himself and his employers; as for the latter, they or their inheritors have by this time found out what sort of manufactured ware he imposed upon them.

THE NEW ROYAL EXCHANGE.

On the 16th ultimo the joint committee for managing the estates of Sir Thomas Gresham met at Mercers' Hall, for the purpose of receiving sealed tenders for the concrete excavation and foundation of the new Royal Exchange, Mr. Richard Lambert Jones in the chair. Twelve of the most eminent builders in the metropolis had been written to on the subject, immediately after the Lords of the Treasury officially agreed to the plan of Mr. Tite, and they accordingly sent in their respective tenders. The tenders varied from about £8,000 to £11,000, and the tender of Messrs. Webb, of Clerkenwell, extensive brickmakers and builders, being the lowest, was unanimously accepted.

The following are the material conditions of the specification of the works to be done in excavating for the foundations and basement story of the new Royal Exchange, in forming the concrete substratum, and in building the foundations, basement walls, and other works, under the direction and to the satisfaction of the architect to the joint committee:—

"Site.—The drawings at present exhibited show the site and plan of the foundations of the proposed building; but the committee and the architect are to be at liberty to vary the plan, or to change the site in any manner that may appear to them desirable, without rendering void, or in any way invalidating, this contract. Should such changes, however, involve any increase or diminution in the quantity or nature of the work, then such increase or diminution shall be fairly ascertained in proportion to the whole cost of the excavation or concrete, and the amount so ascertained deducted from or added to the amount of the contract as the case may require, *mutatis mutandis*.

"No Deviation.—No deviations, however, are to be made from the drawing exhibited and the directions herein contained, without a written authority from the architect or committee; and, in case any part of the work shall be altered without that authority, the same shall be immediately taken down and re-erected at the expense of the contractor.

"Nature of the Works.—The works are to be executed in all respects with the best materials and workmanship, in the most effective and substantial manner, and to the satisfaction of the committee and architect, or such superintendent clerk of the works as may by him be duly appointed.

"Clerk of the Works.—The clerk of the works, in the absence of the architect, is to have full power to judge of the quality of the materials, and of the manner of executing the several kinds of works; in all which particulars the contractor will be required to follow his directions.

"Works to be restored, if injured.—The contractor is to provide for effectually shoring or securing the several walls, piers, and works, as occasion may require, and as the architect may direct; and if any damage should happen to any of the works, either from the weather, from the want of sufficient protection, from insufficiency of the work, from accident, or from any cause whatever, during the progress of the works, the same shall be made good by the contractor.

"Materials and Workmanship, if disapproved of, how to be dealt with.—All the materials used are to be the best of their respective kinds, and strictly in accordance with the directions hereinafter contained:—The workmanship is to be executed in the most sound, satisfactory, and workmanlike manner; and the architect shall have the power to order the removal of any materials brought to the ground which appear to him to be of an inferior quality, or to order the pulling down and reinstatement, or reconstruction, of any work that may in his judgment be performed in an unsatisfactory manner; and the contractor shall remove such imperfect materials and reinstate such defective or improper workmanship within twenty-four hours after a written notice given to him or his foreman, or left at his usual place of abode, and signed by the architect for that purpose; and, should the contractor refuse or delay to comply with the requirements of such notice, then the architect shall have power and be at liberty to suspend the farther execution of the works, to take them out of the contractor's hands, and alter or pull down and reinstate any work, or cause the removal of defective materials by any other workmen that he may employ; the contractor or his sureties paying every expense that may be incurred

thereby, the amount of which shall be settled by the architect (whose decision shall in this case be final), and deducted from the amount of any balance due to the contractor.

"DELAY.—In case the contractor should refuse or delay to proceed with the works undertaken by him, the architect shall be at liberty and fully authorized to carry on and complete the works at the expense of the contractor or his sureties.

"POSSESSION.—The committee will give immediate possession of all the land, except the part occupied by the houses at the east end; possession of that part will be given on the —— day of ——.

"COMPLETION.—The whole of the works concerned in the excavation and concrete are to be completed within three months from the date of possession, and all the brick-work executed at the rate of thirty rods per week, under the penalty of £200 per week for a failure in the completion of either of these conditions.

"PAYMENTS.—The extent of the work done will be ascertained or measured off every month, and ninety per cent. in value of the work done, completed, and finished, shall be paid to the contractor upon the certificate of the architect. The balance of ten per cent. upon the whole amount shall be paid within three months from the completion, unless in case of dispute; and this balance is farther to be held and considered liable for penalties, and for all breaches of the contract and bargain.

"SURETIES.—The contractor will be required, if called upon, to find two sureties, to be approved of by the committee, to be bound jointly and severally with himself for the due performance of the contract, in a sum not exceeding £3,000.

"PRICES.—The prices of the tender are to be strictly applied as described in the schedule with respect to the peculiar modes of measurement or the manner of determining the value of the several works; but, in all cases not so specifically referred to, the ordinary and customary modes of measurement are to be adopted; and should there be any price of materials or workmanship required in making out the bills of work done, which price is not specifically mentioned in the schedule, then such price is to be determined by a fair and reasonable analogy with any work of a like nature or kind, or a price calculated in the same ratio or profit upon the prime cost of the labour or materials, or both, as the case may be, is to be charged and allowed; and in the event of any dispute arising between the architect and the contractor as to the nature of the measurement, or the application and construction of the prices in the schedule, or upon the price of any work or materials not mentioned therein, such difference or dispute shall be determined by arbitration upon the completion of the works.

"AREA OR COURT.—The committee have not yet determined whether the area of the merchants' court is to be excavated, concreted, and vaulted, or otherwise. The contractor will therefore give a sum in the tender, as pointed out therein for this work; and the committee are to be at perfect liberty to abandon this part of the tender or to execute it, as may seem to them expedient.

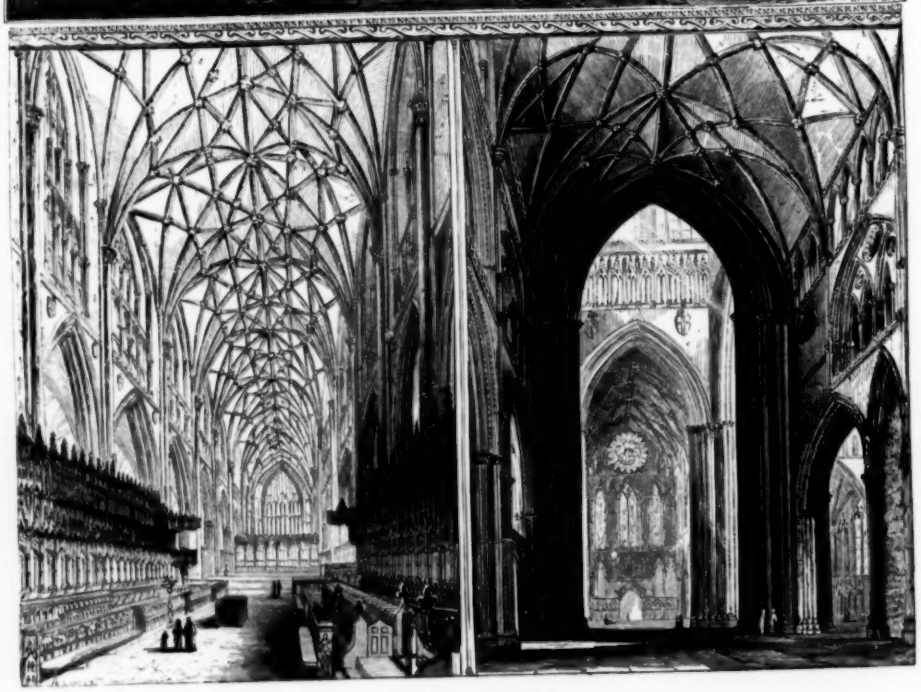
"EXCAVATOR.—The contractor is to find and provide all proper workmen, tools, scaffolds, planks, barrows, and implements for pulling down the old vaults and arches, for getting up the old foundations, and for excavating the earth, gravel, and other materials. All bricks or other materials found are to be his property, and, with the gravel, earth, and soil, are to be carted away and entirely removed: except, firstly, all paving, curb, or pitching stones; secondly, so much of the best stratum of the lower gravel as may be required for filling in the walls round the outside, and also for filling into the main walls of the area of the merchants' court in like manner, should that area not be excavated; and, thirdly, always excepting out of such materials or things as are to become the property of the contractor, any plate, coins, antiquities, or curiosities, whether in metal or otherwise, or any carved stones or carvings in marble, pottery, terra cotta, or tesseræ, which may be found in the course of the excavations; it being distinctly understood that such matters or things are to be taken up with all requisite care, and are to remain the property of the Gresham committee."

The other conditions refer to the workmen, the tools, the brick-work, &c., &c. The works will commence the moment the necessary papers are signed, and there will be no postponement or delay of any kind. Tenders will be shortly received for the superstructure. It is remarkable that the contract entered into with Messrs. Webb is £2,000 below the estimate made by Mr. Tite, the architect. If as the building proceeds the committee find that the superstructure can be completed upon a proportionate contract, they will considerably add to the external beauty and elegance of the New Royal Exchange.

ARCHITECTURE OF THE DAY—THE NEW HOUSES OF PARLIAMENT.

THE wildest productions of nature that ever perplexed the investigator of physical laws are not more extraordinary than the occasional freaks of genius, as they appear in certain cases, where the propriety of adopting a specifically different course would seem to be established by almost universal consent. Doubtless such genius acts upon conclusions justly deduced from a particular train of reasoning; but that reasoning is found perhaps to be based upon only one of the hundred considerations that would suggest themselves to an indifferent mind, as essential to the treatment of the entire subject. Intent upon the improvement of some favourite point of composition, the importance of which seems to increase with every fresh contemplation, or proportionately solicitous to avoid some apprehended defect, the mind of the contriver becomes so exclusively occupied with one department of his undertaking that he no longer sees the subject under those general aspects which it presents to every other observer. Were we metaphysically disposed, we might trace out a long parallel of illustration from the kindred operations of the mind in questions of practical truth and moral obligation, respecting which, when there are ample data presented to our apprehension, the first impressions will commonly be the most just and accurate; while, as every one knows, nothing is easier than for a mind acting under an obliquity of impulse to form, by degrees totally imperceptible, the most distorted views of right, and the most erroneous principles of conduct. Hence, in the investigation of moral truth, the necessity of consulting authorities and opinions extraneous to our own; and hence, not less, in the creations of genius, and in the practice of any of the arts of design, the need for consulting the impressions of others—the eye of a stranger—if we would obtain an unprejudiced and corrective view of a subject to the good and bad points of which familiarity will have made its author in a great measure insensible.

To a much greater extent than we shall think it necessary to expose to our readers are we led privately to carry such a train of reflection as this, when we see men of such redundant genius as Charles Barry induced, upon what we believe fallacious reasons, to make such changes in the conduct of their most important works as those to which we feel compelled now to advert. In speaking of Mr. Barry's New Houses of Parliament, we would have it understood that we avow ourselves among the warmest admirers of his design, as explained in his last published representations; and that we are satisfied that this design, if so carried into execution, would be characterized by great magnificence, resulting from a happy combination of the qualities of unity, magnitude, breadth of effect, and richness of detail. The original composition was, in short, one the selection of which did honour to the taste and discernment of the parliamentary commissioners, and seemed to require only that fidelity should be united with skill in embodying the conception. We confess we entertained little sympathy for the complaints and remonstrances which proceeded from several of Mr. Barry's professional brethren, on the adoption of his design; and, if those gentlemen have not yet seen reason to feel conciliation towards the success of their opponent, we can now hardly imagine any thing more satisfactory to their ill-will than for them to observe the impoverishment to which the river-front of the buildings now in progress appears to be subjected. It may, we own, be thought rather an invidious and premature course for us to express any opinion upon the intentions of an architect, when his work has risen only a few feet out of the ground; but a very sufficient answer may be given to this objection, upon the following plain grounds: in the first place, if the remarks we have to offer possess any force at all, this is the proper time for their consideration, and not when the building is completed, and the mischief, if such it be, is irremediably done; in the second place, it is a fact that, in at least one most essential particular, Mr. Barry's



YORK CATHEDRAL.

CHOIR. TRANSEPTS

E. DANTIEL, PRINTER, BANGOR HOUSE, SHOE LANE.

present design for his river-front differs from that chosen by the commissioners, and sanctioned by parliament, and for the integrity of which Mr. Barry's final appointment as architect was a pledge to the nation. The deviation of which we speak consists in the removal of the whole range of boldly-projecting buttresses, which divided the bays of the river-front in the original design; and the substitution for them, in all cases, of shafts whose plan is four sides of a hexagon, presenting, consequently, an angle in the front, and an extremely slight projection from the face of the building. On receiving our first information with regard to this most important change of purpose, we confess we could scarcely be prevailed upon to consider it as credible; but subsequent inquiry and personal inspection established the fact too certainly, and led us to inquire to what imaginable reasons it might be referred. These reasons, it is suggested, are two-fold: first, that the projection of the buttresses originally proposed would have concealed too much of the lower face of the building between them, as viewed on approaching by the middle of the river; and, secondly, that the shaft-like buttresses now in execution will admit of the more uniform continuation over their surfaces of that system of panelling and tracery which overspreads the whole of the main building.

Now, it does appear to us that these considerations are, in the last degree, fallacious. With an enormous façade of seven or eight hundred feet in length, so little broken as this, the charm of its continuity lay in the repetition of the well-marked alternate forms of buttress and window: what must be the result where the former of these two members is reduced to a minimum? In any extended front, it is clear that variety and interest must be given either by such a distribution of general masses as shall produce diversity of plan and shadow, or else by such boldness of regularly recurring members as shall diffuse an equivalent amount of shadow in the aggregate. The first of these means Mr. Barry rejects, in the case in question; as the general masses of his building are not so varied in plan as to secure that kind of interest which belongs expressly to the picturesque. It is to the second that he must look in the management of this and all continuous fronts, gaining an equivalent of play and shadow in the forcible points of this subdivision. This, we consider, the former design for the front under notice would have attained to admiration; not so the present, in which all the shades and shadows of the buttress shafts must be meagre and softened, destitute alike of sharpness and of breadth. The objection founded upon the slight interception which the larger buttresses would have offered to the view of the lower tier of windows between them, on the approach by water, is one of no force at all; for never yet was it thought a *sine qua non* in Gothic architecture that a building should expose to the first glance of the spectator all its component parts, or that the profiles of a succession of buttresses, as seen in perspective, did not rather excite the imagination, and keep alive the interest to see what remained between them. To this it is to be added that the most fitting point of sight for this façade is to be obtained not upon the river itself, but from its eastern bank, from which, accordingly, all Mr. Barry's published views are taken, and from which the spectator might have as much or as little of that intervention of the buttresses as he might choose.

With regard to the other reason for the present change, which is founded upon the desirableness of equalizing the decoration throughout the entire front, it is scarcely more valid than the former. Indeed, to us it appears that here equalization would be identical with insipidity, and that *repose* is an element of composition of much higher value. This repose would have been happily attained under the original project by the flat undecorated sides of the buttresses, the fronts of which might still have been enriched, to any desirable extent, with panelling, or niches containing statues of the English sovereigns, &c. In fact, this extreme anxiety for the equal diffusion of ornament over the whole of a large mass of building generally defeats its own object. Witness, as a proximate example, the exterior of Henry the Seventh's chapel, which cannot for a moment compete in interest with the shadowy masses of the sober structure to which it is an appendage. This, however, is also attributable in part to another cause, that of the roundness and indecision of the aggregate forms of plan in the former pile, as contrasted with the well-defined masses of the latter; and in this particular, likewise, Mr. Barry's buttress-shafts betray a farther tendency towards what we must call the vitiated taste which discovers itself to a great extent in the external composition of that chapel.

Without quarrelling with Mr. Barry for the want of sufficient precedent for his peculiar form of buttress, to which we object upon intrinsic grounds, and without denouncing him for the continentalism which many discover in his whole design, we must express our surprise that this subject was of all his works chosen for the introduction of a feature so peculiar. Had such shafts appeared in the place of the present buttresses in the principal front of his Birmingham Grammar School, detrimental as we think the change would have been to that admirable composition, we should not have been equally surprised as in this instance. There the points of view are limited by the width of an ordinary street, and the same interception is produced by the advancing buttresses that seems so much an object of apprehension in the buildings at Westminster. At Birmingham, too, the continuity and extent of the front are not so great as to make it necessary to render these members of subdivision very forcible. At Westminster the reverse of all this is the case: a front of enormous length, whose general divisions are extremely simple, and deviate but slightly from one plane of surface, must be the very subject, if ever one existed, to demand great breadth and force in the filling-in members, which are, as we have said, alternate windows and buttresses. It may be quite true that the modification at present adopted may look very well in a carefully prepared model or drawing, which exhibits elaborately just one or two bays of the front; but it is altogether another affair when for one bay we have nearly thirty. There is no recipe for making a façade that shall be imposing on a distant view by a mere multiplication of minute sections expressly decorated for a close inspection. So fully are we satisfied of this truth that, at all risk of the charge of officiousness, we cannot help reiterating the hope that Mr. Barry may be induced to re-consider the matter upon which we have animadverted. We have felt no ordinary interest for the successful development of his design; and can consider the modifications now proposed as nothing less than fatal to a work in which we expected to realize the highest achievement of the present century in the architecture of the metropolis. Such feelings must plead our excuse for having continued these remarks to so great a length; and, assuredly, how silent soever we might have remained upon this subject, it is precisely that which might be expected to furnish hereafter a more than plausible text for the criminations of Mr. Hopper, Mr. Cottingham, and others of Mr. Barry's eagle-eyed opponents, whose acuteness in discovering a failure is not likely to be surpassed by their charity in concealing it. T.

October 22nd, 1840.

GRECIAN AND GOTHIC ARCHITECTURE CONTRASTED.

WITH AN ENGRAVING OF YORK MINSTER.

Our readers are already acquainted with the opinion lately put forth by Mr. Wightwick, in regard to the Parthenon and York Minster,—one that can be nothing short of startling and bewildering to those who have been trained up to put implicit faith in classical models, in the styles of Greece and Rome, for it is calculated to upset their doctrine, and to turn all their ideas completely topsy-turvy. Again and again has it been asserted, not only that Grecian architecture, or what is comprised under that term, contains in itself all the purest elements of beauty; but that, in comparison with it, all other styles, let their particular merits be what they may, are barbarous in principle, capricious, and lawless. Nay, we once heard it asserted, to our amusement, if not to our edification, and that too, almost ex cathedra—for the opinion was delivered in an essay read before an architectural assembly—that Gothic architecture is altogether arbitrary, without anything like fixed rules; consequently, "one man's Gothic was quite as good as another's;" which rather hastily jumped at conclusion did not give us any very high idea of that ultra Greek's logic and powers of argument. We, on the contrary, are disposed to draw quite a different inference from his, and say that, according to his own showing, "one man's Greek is quite as good as another's," as, indeed, we find to be pretty gene-

YORK CATHEDRAL.

CHOIR. TRANSEPTS

J. BENTLEY, PRINTER, BANGOR HOUSE, SHOE LANE.

present design for his river-front differs from that chosen by the commissioners, and sanctioned by parliament, and for the integrity of which Mr. Barry's final appointment as architect was a pledge to the nation. The deviation of which we speak consists in the removal of the whole range of boldly-projecting buttresses, which divided the bays of the river-front in the original design; and the substitution for them, in all cases, of shafts whose plan is four sides of a hexagon, presenting, consequently, an angle in the front, and an extremely slight projection from the face of the building. On receiving our first information with regard to this most important change of purpose, we confess we could scarcely be prevailed upon to consider it as credible; but subsequent inquiry and personal inspection established the fact too certainly, and led us to inquire to what imaginable reasons it might be referred. These reasons, it is suggested, are two-fold: first, that the projection of the buttresses originally proposed would have concealed too much of the lower face of the building between them, as viewed on approaching by the middle of the river; and, secondly, that the shaft-like buttresses now in execution will admit of the more uniform continuation over their surfaces of that system of panelling and tracery which overspreads the whole of the main building.

Now, it does appear to us that these considerations are, in the last degree, fallacious. With an enormous façade of seven or eight hundred feet in length, so little broken as this, the charm of its continuity lay in the repetition of the well-marked alternate forms of buttress and window: what must be the result where the former of these two members is reduced to a minimum? In any extended front, it is clear that variety and interest must be given either by such a distribution of general masses as shall produce diversity of plan and shadow, or else by such boldness of regularly recurring members as shall diffuse an equivalent amount of shadow in the aggregate. The first of these means Mr. Barry rejects, in the case in question; as the general masses of his building are not so varied in plan as to secure that kind of interest which belongs expressly to the picturesque. It is to the second that he must look in the management of this and all continuous fronts, gaining an equivalent of play and shadow in the forcible points of this subdivision. This, we consider, the former design for the front under notice would have attained to admiration; not so the present, in which all the shades and shadows of the buttress shafts must be meagre and softened, destitute alike of sharpness and of breadth. The objection founded upon the slight interception which the larger buttresses would have offered to the view of the lower tier of windows between them, on the approach by water, is one of no force at all; for never yet was it thought a *sine qua non* in Gothic architecture that a building should expose to the first glance of the spectator all its component parts, or that the profiles of a succession of buttresses, as seen in perspective, did not rather excite the imagination, and keep alive the interest to see what remained between them. To this it is to be added that the most fitting point of sight for this façade is to be obtained not upon the river itself, but from its eastern bank, from which, accordingly, all Mr. Barry's published views are taken, and from which the spectator might have as much or as little of that intervention of the buttresses as he might choose.

With regard to the other reason for the present change, which is founded upon the desirableness of equalizing the decoration throughout the entire front, it is scarcely more valid than the former. Indeed, to us it appears that here equalization would be identical with insipidity, and that *repose* is an element of composition of much higher value. This repose would have been happily attained under the original project by the flat undecorated sides of the buttresses, the fronts of which might still have been enriched, to any desirable extent, with panelling, or niches containing statues of the English sovereigns, &c. In fact, this extreme anxiety for the equal diffusion of ornament over the whole of a large mass of building generally defeats its own object. Witness, as a proximate example, the exterior of Henry the Seventh's chapel, which cannot for a moment compete in interest with the shadowy masses of the sober structure to which it is an appendage. This, however, is also attributable in part to another cause, that of the roundness and indecision of the aggregate forms of plan in the former pile, as contrasted with the well-defined masses of the latter; and in this particular, likewise, Mr. Barry's buttress-shafts betray a farther tendency towards what we must call the vitiated taste which discovers itself to a great extent in the external composition of that chapel.

Without quarrelling with Mr. Barry for the want of sufficient precedent for his peculiar form of buttress, to which we object upon intrinsic grounds, and without denouncing him for the continentalism which many discover in his whole design, we must express our surprise that this subject was of all his works chosen for the introduction of a feature so peculiar. Had such shafts appeared in the place of the present buttresses in the principal front of his Birmingham Grammar School, detrimental as we think the change would have been to that admirable composition, we should not have been equally surprised as in this instance. There the points of view are limited by the width of an ordinary street, and the same interception is produced by the advancing buttresses that seems so much an object of apprehension in the buildings at Westminster. At Birmingham, too, the continuity and extent of the front are not so great as to make it necessary to render these members of subdivision very forcible. At Westminster the reverse of all this is the case: a front of enormous length, whose general divisions are extremely simple, and deviate but slightly from one plane of surface, must be the very subject, if ever one existed, to demand great breadth and force in the filling-in members, which are, as we have said, alternate windows and buttresses. It may be quite true that the modification at present adopted may look very well in a carefully prepared model or drawing, which exhibits elaborately just one or two bays of the front; but it is altogether another affair when for one bay we have nearly thirty. There is no recipe for making a façade that shall be imposing on a distant view by a mere multiplication of minute sections expressly decorated for a close inspection. So fully are we satisfied of this truth that, at all risk of the charge of officiousness, we cannot help reiterating the hope that Mr. Barry may be induced to re-consider the matter upon which we have animadverted. We have felt no ordinary interest for the successful development of his design; and can consider the modifications now proposed as nothing less than fatal to a work in which we expected to realize the highest achievement of the present century in the architecture of the metropolis. Such feelings must plead our excuse for having continued these remarks to so great a length; and, assuredly, how silent soever we might have remained upon this subject, it is precisely that which might be expected to furnish hereafter a more than plausible text for the criminations of Mr. Hopper, Mr. Cottingham, and others of Mr. Barry's eagle-eyed opponents, whose acuteness in discovering a failure is not likely to be surpassed by their charity in concealing it.

T.

October 22nd, 1840.

GRECIAN AND GOTHIC ARCHITECTURE CONTRASTED.

WITH AN ENGRAVING OF YORK MINSTER.

Our readers are already acquainted with the opinion lately put forth by Mr. Wightwick, in regard to the Parthenon and York Minster,—one that can be nothing short of startling and bewildering to those who have been trained up to put implicit faith in classical models, in the styles of Greece and Rome, for it is calculated to upset their doctrine, and to turn all their ideas completely topsy-turvy. Again and again has it been asserted, not only that Grecian architecture, or what is comprised under that term, contains in itself all the purest elements of beauty; but that, in comparison with it, all other styles, let their particular merits be what they may, are barbarous in principle, capricious, and lawless. Nay, we once heard it asserted, to our amusement, if not to our edification, and that too, almost ex cathedra—for the opinion was delivered in an essay read before an architectural assembly—that Gothic architecture is altogether arbitrary, without anything like fixed rules; consequently, "one man's Gothic was quite as good as another's;" which rather hastily jumped at conclusion did not give us any very high idea of that ultra Greek's logic and powers of argument. We, on the contrary, are disposed to draw quite a different inference from his, and say that, according to his own showing, "one man's Greek is quite as good as another's," as, indeed, we find to be pretty gene-

rally the case, as far as columns, entablatures, and a few other things of that sort are concerned, which constitute almost all the elements of that style, and which admit of comparatively very few combinations and modifications, unless we choose to innovate rather freely, guided rather by feeling than by precedent.

Quite contrary to the authoritatively expressed opinion above quoted, most certain it is that there is a prodigious difference between one man's ideas of Gothic and another's, as exhibited in their respective works, and that few of those who have attempted have entered into the genius of that style. Yet, so far from being at all conclusive as to the inferiority of that mode of architecture, it rather proves how exceedingly complex it is in its principles, how many more rules it requires to be observed, and how many circumstances it embraces for which rules are scarcely of any avail. If we may be permitted to illustrate the respective characters of the two styles by such analogical comparison, we should say that Grecian architecture is marked by perfect propriety and good breeding: its graces and its refinement are those of the drawing-room; it is all decorum, and all etiquette: its amiabilities are of that kind into which people—even the stupidest—may be initiated by rule, they being entirely conventional on the part of those who adopt them, without other feeling than of their convenience as well-bred hypocrisies. Gothic architecture, on the other hand, may be likened to nature herself, infinite in variety, and almost boundless in its combinations; exhibiting every character and every mood of each, and following those impulses which may possibly lead to extravagances. Like Mr. Wightwick's own remark, what we have just been saying, must, of course, be taken *cum grano salis*, and not understood too literally; but, if properly interpreted, it will serve to convey our estimate of the different styles both more forcibly and more accurately than we could do within the same compass by a less fanciful expression of it.

If we are content with negative merit of decorum in architecture, more anxious to be studiously *comme il faut* than solicitous of displaying higher merits at the risk of giving offence, we have but to adopt Grecian architecture, or at least the style received under that title as orthodox. The taught-by-rule and learnt-by-rote correctness of the classical school is of comparatively easy attainment: by following a few recipes almost any one of ordinary capacity may quickly attain to a certain proficiency and dexterity in it; and, although what is so concocted may turn out to be most vapid and stale, it can be proved to be perfectly *secundum artem*, and, consequently, entitled to approbation. They are designs classical, and so too are French tragedies, in regard to which, some one has, more sensibly than politely, remarked that, when you happen to *assist* at one, you have no occasion whatever for a pocket handkerchief, but very great occasion indeed for—a night cap!

For those who are content to be orthodoxly and legitimately dull no road is so safe as the level and well trodden one of the "five orders," for so that column and entablature be correct, according to the standard established for them by those who have reduced them to rule, it matters very little how incongruous all the rest may be, how completely dissimilar in character, how utterly discordant and disproportioned. That the orders of antiquity should have been studied with minute diligence and with indiscriminating reverence by those who first sought to revive the style of imperial Rome and Roman Italy, was no more than natural, even laudable: the consequences, on the contrary, have proved not a little injurious, for such reverence, afterwards degenerated into blind and stupid superstition, which insisted upon the most punctilious adherence to established authority, in regard to certain particulars, and, nevertheless, tolerated the utmost licentiousness and caprice, the greatest latitudinarianism, in practice, in every other respect. Hardly would this have happened had not positive and limited rules been substituted for principles; but, then the former are vastly more convenient than the latter; they require no particular talent for the art, no other capacity than that of ordinary memory and attention; whereas, with principles, the case is widely different, for, even when understood, it is not always easy to know how to apply them to the particular occasion—a difficulty by the by usually got over by evading it altogether. Attention to a few details is made a positive merit of such extraordinary efficacy as to secure absolution in full for all architectural sins, let them be ever so flagrant: and the same one-sided microscopical taste which regards only detached parts and items, without taking any account of the total effect of the summing up of the character so produced, has infected criticism likewise. Nowhere has the genius of the classical style of antiquity been less understood,—nowhere is it less relished even at the present day, than in Italy itself. The works of Calderari and Cagnola sufficiently attest this: compared with many of those of a former period, and of great note in their day, and still carefully noted for admiration in guide-books, they are purity and elegance itself, though not always free from insipidity; yet, they certainly have very little in common with the antique. Were the difference occasioned by a free interpretation of the principles of Greek architecture, and by a well-studied and consistent modification of them, the difference would be a merit rather than a defect. Unfortunately, it is not so: instead of a complete architectural amalgamation taking place, only a sort of architectural inlay-work is produced, wherein ancient and modern taste are dovetailed together, but allowed to show themselves contrasted to, and distinct from, each other. No attempt is made to approximate the one to the other in character. To make that for which ancient buildings afford no example, nor even type, appear imbued with antique gusto is, it seems, what *can't* be done; while, to deviate at all from the usual models, for the purpose of making what is so borrowed tolerably of a piece with the rest, and, also in order to avoid the eternal repetition of the same stereotype forms, is what *must not* be done on any account whatever.

It is really amusing, and it might also be instructive, to read some of the vituperative tirades of Vasari and others against Gothic architecture as a monstrous depravation of art, a most barbarous mode of building, without science, without principles, without proportions, without harmony, without meaning, in short, *sans* every thing—a mere congeries of rude discordant parts, and of uncouthly fantastic and capricious ornaments. Their invectives become almost complimentary, when we consider the taste which dictated them, and which, so far from being scandalized at, could admire, as most excellent and most legitimate, what are positively little better than burlesques on classical architecture, if to be received as imitations of it, its principles being altogether discarded for others, and merely the semblance of certain parts retained, but so contradictorily are such members applied, and so little do they retain of their original value and character, when reduced from the quality of principal features to that of being subordinate, expletive, and adscititious ones, that a table with legs shaped to resemble Doric or other columns would convey quite as correct an idea of Grecian architecture, as a style, as is to be obtained from many buildings which have been admired as strictly classical in taste for no other reason than that they exhibit passable imitations of Greek or Roman columns,—Doric, indeed, starved into lankiness, and Ionic, with "cropped ear" capitals. At the best, such imitations give us but the frippery of the antique, its *disjecta membra* arbitrarily patched together, without any regard to that perfect symmetry and harmony of proportion which constitute its real character, but of which not a trace is observable in the *soi-disant* copies, although they have been extolled as exhibiting those qualities.

At length justice has been done to the "stupendous barbarism of the middle ages;" Gothic architecture has obtained equal, if not greater, admiration, in this country at least, than the remains of Greece and Rome; and most certainly it infinitely surpasses the latter in variety, in the scope it affords for design, and in the inexhaustible combinations to which it freely lends itself. For the favour it has obtained it is no doubt greatly indebted to the interest attending it as a branch of historical and antiquarian study, and it has accordingly exercised the pens and the ingenuity of a host of writers, but chiefly with reference to its origin, or rather the origin and first application of the pointed arch, which question, after giving rise to many dexterous conjectures and plausible theories, still remains unsolved, and the theories themselves merely speculative hypotheses, with more or less of probability to recommend them, they being unsupported by any direct and irrefragable historical evidence. Yet, although that question has not been, and very probably never will be, satisfactorily settled—or, if it were, it would merely gratify curiosity—the inquiries directed to it have not been entirely in vain, because it is owing to them that a vast mass of historical information has been accumulated relative to the various styles and epochs of the art. Still the information thus afforded, even including what has since been added of a more strictly architectural

nature, is by far too desultory and fragmentary to afford a clear and connected insight into the true principles and genius of Gothic architecture in all its varieties, including those national peculiarities which it exhibits in different parts of Europe. A complete historic *parallel* of it would be a most invaluable, but *is* a never-to-be-hoped-for work. Indeed, it is only of very late years that we have had any exact and authentic studies of details and individual features of Gothic architecture, there being no work supplying any thing of the kind, except an occasional specimen, previously to those undertaken by the late Augustus Pugin,* to whom the architectural world is deeply indebted, for his valuable labours in that department of art. Very far are we from being insensible to the charm of such tasteful, and no less accurate than tasteful, delineations of Gothic buildings, as those by Mackenzie, Cattermole, Wild, Shaw, &c., but they are, for the greater part, only pictorial and perspective representations, and those, moreover, confined almost exclusively to ecclesiastical structures. For the information of the practical architect, or indeed for every one who wished to make himself acquainted with the real organization and constitution of the style, very much more was wanted. And the details of Gothic architecture are so exceedingly varied and complex, and are, besides, so indispensably important, that to pretend to study the style merely from its general forms is like studying botany from a view of a botanic garden, or like attempting to draw a Corinthian column without knowing any thing of the adjustment and the ornaments of a Corinthian capital. Of the importance of most careful attention to detail in Gothic architecture, sufficient, though most unsatisfactory, proof is afforded by most of our modern buildings in that style, even by those which exhibit no very glaring errors, but are passably correct as to the mere outline of the forms, nevertheless, altogether maimed and defective as regards the features so expressed. It is strange that those who would on no account venture to take the slightest liberty with the established proportions or ornaments of any of the orders, feel no scruple in altering or changing altogether those of Gothic windows, &c., making mullions half the breadth they ought to have, or even less, and thereby quite destroying the proportions they ought to bear to the lights between them; and attenuating other mouldings after a similar fashion; besides, perhaps, omitting many others as redundancies that will never be missed, especially by those more goodnatured than fastidious critics who condescend to speak of such things as being in "a chaste style of Gothic." We need not be personal, nor point to particular examples of this mean, impoverished, *soi-disant* modern Gothic, they being rife enough among our new churches, and the greater difficulty being to point out any striking exceptions. It is not our dislike but our admiration of Gothic architecture which causes us to regret that it should be so very popular just now for church-building. If they do not manifest the ignorance displayed by the architects of the "Carpenters'-Gothic" school, most of the edifices of the kind either designed or executed of late exhibit a singular want of feeling for the style and most terrible infelicity of conception. It is little satisfaction to be told that the miserable penuriousness which stamps them, and in comparison with which the homeliness of a village church is positively delightful and respectable, is to be imputed not to the architect but to his employers. Some portion of blame, besides, will generally be found to attach to the former, since it behoves the architect to treat his design accordingly, and to make the whole consistently plain and unpretending, instead of, as frequently happens, impoverishing all the rest for the sake of introducing two or three bits of would-be finery, but which, in such cases, become no more than ridiculous tawdry, because utterly incongruous to the rest. Scantiness of funds may be a very sufficient reason for erecting only bare walls and openings in them for windows; but it is no reason whatever for aping Gothic, or indeed any other style which requires any sort of finish.

Just now there seems to be a predilection in favour of the "Early-pointed," as being, we suppose, cheap and tasty, though, as we find it generally executed, we should be inclined to put the last epithet into an erratum, and say for *tasty* read *nasty*. If lancet-headed holes in a wall suffice to constitute Early-pointed, we must be excused from admiring it, not being at all disposed even to tolerate it. It may exhibit the rudiments, real or supposed, of pointed architecture; but, if so, it is only in its mis-shapen, embryo, unhatched state, and bears no more resemblance to the style itself than a log-house does to the Parthenon, or any other Greek temple. At the present day to revert back to the very infancy of a style for our models in it is most preposterous,—a sort of pedantry bewitched,—an extravagant affectation of rudeness that is of all sophistications the most sophisticated. We can understand the going back to a former perfected style for models in art, but that we should think of adopting the scanty rudiments of an undeveloped one, is to us passing strange, more especially when we perceive that, instead of any effort being made to refine them, moulding them into a different character from that which they gradually assumed after their former infant state, we actually deprive them of all vitality, and destroy every latent principle of beauty. Did our imitations of such models present us with the simple native rudeness of the originals, they would at least have one respectable quality; instead of which the buildings now professing to be in that style are chiefly remarkable for their paltriness and pertness—for their consummate vulgarity of taste. Our modern Early-pointed exhibits nothing of the infancy but a very great deal of the childishness—the second childhood and dotage of art, together with most miserable and miserly affectation. If we must have cheap churches, so be it; but let us not have ridiculous and contemptible ones. But we are now getting splenetic, and are getting besides quite out of our track, and forgetting our subject. Yet as for subject we may as well disown it at once, for our article has turned out such an exceedingly rambling and desultory one, that we are unable to say exactly what the subject of it is; however that is of little importance, provided there be any thing in it worth the reader's consideration.

We set out with alluding to Wightwick's paradoxical opinion relative to York Minster and the Parthenon, and now make an observation which seems to have escaped him, namely that it would be infinitely more easy to produce a *fac-simile* of the latter than of the former. The Grecian edifice is understood at a glance; it is perfect; but its perfection does not include—perhaps excludes, that charm of infinite variety which attends the Gothic one, whose manifold complexity lends it unsating attractions, whereas the uniformity of the other is apt to pall upon the eye. In no respect does the difference between the *genius* of the two styles manifest itself more strongly than in the severe simplicity, not to call it formal preciseness, of the one, and the exuberant *many-sidedness* and *polymorphism* of the other. They are opposed to each other as the classical and the romantic manifestation of art. Take all the Greek temples together and they offer little more than a slight variation of the same idea; while of Gothic cathedrals no two are alike; so far from it that they display greater diversity, and more combinations, than does almost the entire range of classical architecture in all its forms. The amount of difference, in this respect, becomes greater when we take into the account the almost total absence of interior architectural design in the Grecian buildings, and the accumulated display of it in the Gothic ones. So *voluminous*, indeed, are these last in regard to their designs, both outward and within, that to describe any one of them fully, to analyze all its parts, to note all its features, to study all the combinations and varied effects produced both by perspective and by light and shade, and to mark all the mysteriously intermingling harmonies and contrasts of the whole, to unravel and explain them, would be no brief occupation. As Mr. Wightwick has singled out York, we must presume that to be his favourite cathedral, and we also incline to assign it a superiority upon the whole, notwithstanding that some others excel it in particular features and parts, and that it does not possess that noble ornament, a spire. "The more minutely this magnificent edifice is examined," says Rickman, "the more will its great value appear. The simplicity and boldness, and, at the same time, the great richness of the nave,

* Besides the value of their subjects as studies, and the beautiful execution of the plates, Mr. Pugin's "Specimens," and also his "Examples of Gothic Architecture," greatly recommend themselves by their convenience of form, which does not exceed the usual 4to size. Unimportant as this may be deemed, it is a very material advantage in books, not intended to be occasionally brought out for display, but to be studied and constantly referred to, as will be admitted by all who have experienced the annoyance attending cumbrous unwieldy volumes, the letter-press of which cannot be perused with any comfort, and of which the plates are, not unfrequently, unnecessarily large; consisting, in some instances, as in Hirt, and Seroux d'Agincourt, of a number of small subjects comprised within a single plate. In Pugin's works, on the contrary, the minutest details are fully explained. Meritorious and valuable as these publications are, they can be regarded as little more than a beginning towards, we will not say a complete course of such studies, but such an one as would afford a tolerably adequate series of all the principal component parts and features of Gothic architecture in its various styles.

and the very great chastity of design and harmony of composition of the choir and great tower, render the building more completely one whole than any of our mixed cathedrals; while the exquisite beauty of the early character of the chapter-house and its approach forms a valuable link to unite the early English transepts and the decorated nave." Let the reader contrast this fabric with the Parthenon or any other Greek temple, and then condemn Mr. Wightwick if he dare, for the extravagance of his expression or the obliquity of his taste. For such comparison no delineation of the Grecian structure is required, as it must be sufficiently familiar already to the recollection of every one; or, if not, an adequate idea of its character may be obtained from the plate of "Greek Temples," in our last number; but, for York Minster, some exact and positive representation is necessary for the purpose, because, though he were acquainted with every other example of Gothic architecture, a person would be unable, without such assistance, to understand, from any general indications of it, that individual one, which, be it either a merit or defect, is not the case with regard to the other style. Such information is supplied by the annexed cut;* though it will be found to convey only very partial and limited information with regard either to the exterior or interior of a structure composed of so many limbs, as it were, and their articulations, and in comparison with which the finest temples of classical antiquity may be likened to those reptiles which are destitute of limbs or members of any kind. For this last not very flattering simile we must be forgiven; nor do we employ it so much for the purpose of disparagement, as for that of illustrating by it the unvaried and *limbless* bodies of Grecian structures. Most undoubtedly these latter are in the highest degree simple, but, is not simplicity or *singleness* carried in them to excess, so as to be a defect rather than a perfection, depriving them of that kind of beauty which arises from variety, and which produces not one but a succession of pleasurable emotions in the spectator? This is a question that would lead us into a wide field of æsthetic speculation and discussion, we must, therefore, postpone it to some other opportunity. In the meanwhile we leave it to the consideration of our readers, desiring them only to note the picturesque richness of character produced by the *grouping* of the different *limbs* of the structure in York Minster, which, as seen from different points of view in the building itself, impart to it animation, life, and motion.

The view of this particular cathedral will hardly be rendered less interesting on account of the two deplorable calamities by fire which have befallen it within little more than ten years, viz. on February 2d, 1829, and again on the 20th of last May; the first conflagration occasioned by the wilful act of an incendiary madman; the other attributed to accident — in other words, to most culpable negligence and stupidity, quite as mischievous as intentional destruction. In the former instance, it was the choir of the building which was nearly destroyed; in the last, the roof and other parts of the nave, besides a considerable portion of the south-west tower of the front, which is the one shown in the accompanying view.

NEW SYSTEM OF CONSTRUCTION IN ROOFS, BRIDGES, &c.

INVENTED BY M. LAVES, ARCHITECT TO THE KING OF HANOVER.

WITH ENGRAVINGS.

THIS system of construction is applicable to roofs and bridges of every denomination, such as draw and swing bridges, but especially for suspension bridges where the locality on either side, or on both, does not admit of secure fastenings for the chains. For covering large rooms, riding schools, and other openings of large space, it is particularly useful; also the erection of scaffolding, and ladders of large dimensions, and to the stiffening of beams, masts, and supports in general. The plates fully explain the system, and show a variety of purposes to which it may be applied.

This new principle consists in a combination of the two principal forces of materials, that of resistance to compression, and resistance to tension. The first of these forces has been used from the remotest periods in the construction of bridges and arches in general; the second has been more lately employed — at least in Europe — for the construction of suspension bridges by the application of chains. The first requires great masses of materials and strong abutments; the second requires less materials than the first, but secure fastenings for the chains are frequently obtained with difficulty. Very sensible vibrations and undulations are experienced where this last mode of construction is employed. All these inconveniences have prompted the present invention; and the inventor feels convinced, by the most scrupulous researches, of the originality and perfection of his system. In examining fig. 1, it will be perceived, the chain, *a k g*, fastened at the extremities of the bow, acts with the positive force of tension, which is the strongest materials possess, varying from 10 to 20,000 lbs. for every square inch of the transverse section of the several kinds of wood employed in construction, and from 20 to 100,000 lbs. for the several metals.

The bow, *a d g*, by its resistance to compression, serves to prevent the chain, *a k g*, from contracting or drawing together the extremities *a* and *g*. The lower bow, *a k g*, acting as a chain, prevents the upper bow, *a d g*, from pushing or pressing out at the points of support. The vertical and diagonal struts unite in a firm manner the two bows; and the two forces thus neuturalized form a complete whole that sustains itself, and can neither thrust out nor draw in.

It must be observed, first, that the strength of the chains — which acts in a similar manner to that of suspension bridges — depends upon the depth of the versed sine, and that the more they deflect below the horizontal line or chord of the arc the stronger they would be: secondly, that the upper bow — owing to the elasticity of material — must absolutely have the convex form, as in the diagrams; so that when any great sudden weight is thrown on it, causing the lengthening of the chains by tension, and the shortening of the upper bow by compression, the upper bow may not be reduced to a horizontal line, *a n g*, beneath which it could no longer serve by resistance to the statical equilibrium of the construction. Thirdly, that the method of combing the extremities, *a* and *g*, of the bows, must depend on the materials employed; for instance, in a wooden bridge, the notching and scarfing at the joints of the different pieces of wood ought to be calculated and executed to the force which they have the power of resisting. The rules and forms most applicable to these joints have also been proved by the experiments of the inventor.

Having explained, by fig. 1, the application of this system in a horizontal direction, its application to supports or braces placed vertically or obliquely may now be considered. It is obvious that the resistance of supports or stays, either in wood or metal, will be greater as the diameter is increased. A very simple manner presents itself for augmenting the diameter in the middle of a support without very sensibly increasing its weight or its primitive bulk: for wood, the pieces are sawn longitudinally in one or two cuts, to within a certain distance of the ends, and there tied together by bolts or straps of iron, to prevent the slits continuing farther; the cuts are then forced open by blocks, retained in their places by pins or straps of iron. If iron, two or more bars are connected at their extremities; the same method is followed as with wood, in separating them by wedges; or several iron plates, with holes for the bars to pass through, may be employed with equal effect. The proportions and numbers of the different parts, such as chains, supports, stays, braces, &c., depend upon the purposes to which they may be applied, and should be calculated by the architect accordingly.

One of the fittest practical applications of this system is to the construction of iron bridges. A bridge of small dimensions, and having but little weight to support, may be executed by using two trussed girders, one on each side. If a greater strength is necessary, three might be used, one on each side and a central one; in fact, as many such girders should be used as the weight of the bridge requires, which is one of the principal advantages in this new system; for the weight resting on the trussed girders, they may

* For the use of this we are indebted to the proprietor of the Church of England Magazine (Mr. Burns); and, in making this acknowledgment, we cannot refrain from paying our tribute of admiration to those productions as specimens of wood engraving, which, for both spirit and delicacy of execution, are decidedly superior to any we have before seen of architectural subjects, so exceedingly minute and intricate, and so full of detail; they do the engravers (Messrs. Whimpers) great credit. Canterbury cathedral has been similarly illustrated, in the same publication, by one exterior and two interior views, finished with equal beauty; and other subjects will appear in succession. We have no doubt, therefore, that, as the price is exceedingly low, many of our readers will procure either the parts which contain them, or separate impressions of those engravings.

THE CONSTRUCTION OF ROOFS AND BRIDGES.

BY M. LAVES.

Fig. 2.

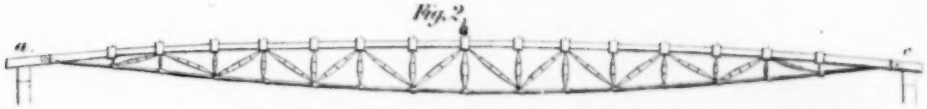


Fig. 1.

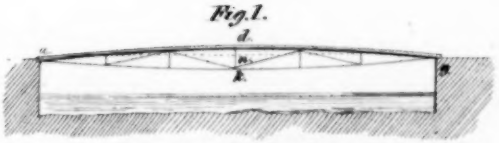


Fig. 3.

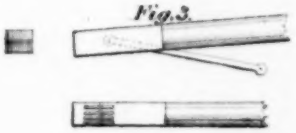


Fig. 4.

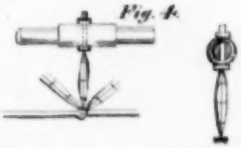


Fig. 5.

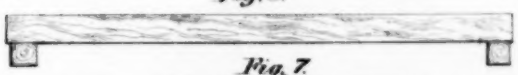


Fig. 6.

Fig. 7.

Fig. 8.

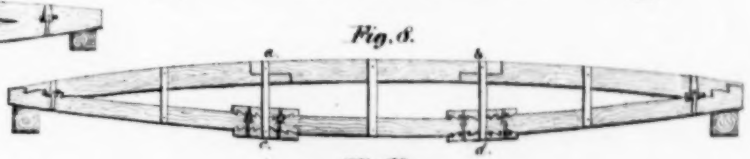


Fig. 9.

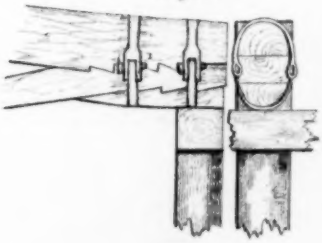


Fig. 10.

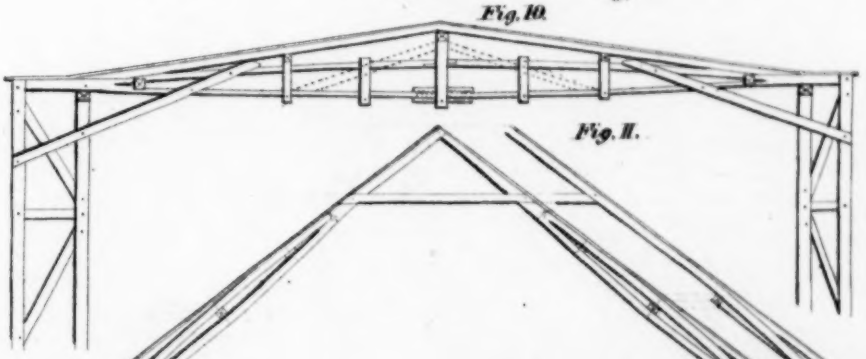


Fig. 11.

Fig. 12.

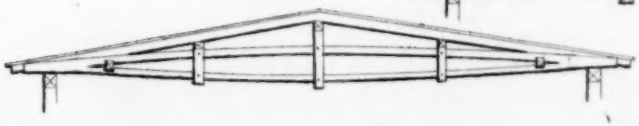


Fig. 13.

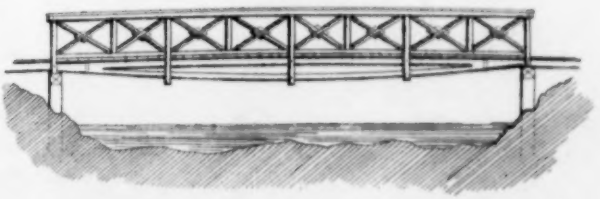


Fig. 14.

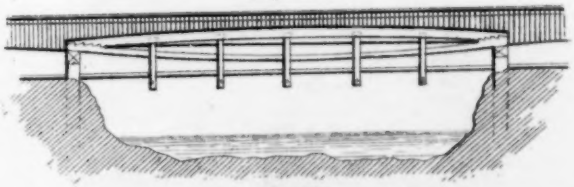


Fig. 15.

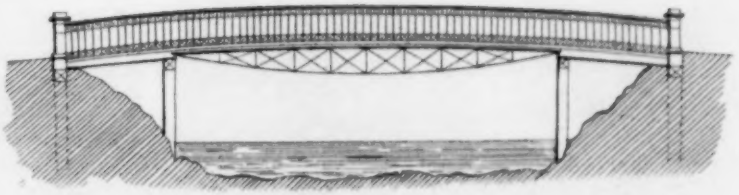
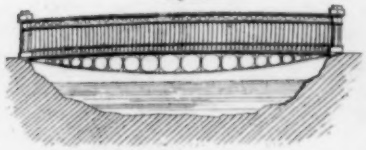


Fig. 16.



L. Steinberg lithe: 108 Hatton Garden.

London, Published by Grattan & Gilbert, 51, Paternoster Row. Nov 1. 1840.

be used to any number that the circumstances require, while in ordinary suspension bridges, the weight must be supported by a very limited number of chains.

The chains—if the bridge is of a moderate span—may, for facility and economy of construction, be executed in one length; while several bars might be used where a bridge of a greater dimension is requisite. In applying this system to bridges of a great span, it is necessary that the upper part be as light as possible. Therefore, the upper bow, *a b c*, fig. 2, is constructed of cast-iron cylinders joined together by bands of wrought-iron. To provide for the fixing of the upper to the lower bow, the extremities of the upper bow should be square, and cast with as many openings as the number of the chains require, as in fig. 3. Fig. 4 shows the method of uniting the lengths of tube, also the manner of fixing the stays and supports, which may be of cast-iron, but wrought-iron is preferable.

A simple application of this system to the construction of wooden bridges is by sawing beams lengthwise into two to within a short distance of their ends, binding the ends with bolts or straps of iron, and fixing wedges or blocks in the slit, as shown by figs. 5 and 6. Beams may be very much stiffened in this manner, and, thus trussed, will deflect much less under the weight they have to carry than in their natural state.

Should the span of a bridge exceed the length of one beam, two or more may be employed, as shown by figs. 7 and 8. The manner of uniting the two bows at their extremities is illustrated by fig. 9; the bracket, it will be observed, gives a horizontal bed to the beam. The form and dimensions of the scarfing and notching, or teeth, must depend on the quality of the wood employed, and the force of adhesion of the fibres of the several kinds of wood. At all the joints where the ends of the timbers abut it will be expedient to interpose thin plates of copper or iron, to prevent the but ends from driving by the force of compression into the beams with which they are connected, which would cause a sinking of the whole structure.

This system presents an easy method of using forked branches of trees in the construction of bridges for occasional purposes, or for military operations, which would also be useful and picturesque if employed in parks and gardens. The connecting of the pieces, and the supports or stays and braces, would be similar to those already described for other bridges. Forked branches might also be occasionally used with much economy instead of the more costly manner of connecting beams at their extremities by scarfing and notching.

For all the bridges hitherto described it will be sufficient if the versed sine of the lower bow or chain is equal to one-twenty-fifth of the span. This deflexure ought to seem very moderate, as an ordinary beam requires to be one twentieth of the span in depth.

Should the banks of a river be too wide apart to admit the adoption of this system in one span, it will be expedient to employ a succession of framings supported on intermediate piers, formed of piles, strapped together with iron, or constructed wholly of cast-iron. If the banks of a river be too little elevated above high-water mark, or if it be requisite to give greater heights in the middle of a series of framings, in order to admit the passage of vessels, the side framings may have a gradual fall to the banks, without affecting the stability of the bridge. From the stress of bridges constructed on this new system acting but in a vertical direction on the intermediate columns, it would be easy to place drawbridges in any part of the length that might be requisite.

The application of this system to roofs and floors of large span is extremely economical and useful, and by simple modifications serves for the covering of large spaces without any intermediate points of support, and also presents this farther advantage, that from its vertical pressure it requires no other support than walls of moderate thickness. When applied to floors, bridging joists will remedy the inequality of the surface in the beam itself. In roofs of large span the posts may be continued upwards, so as to receive the purlins, and, when continued downwards, serve to hold up the ceiling, whether flat, vaulted, or mixed, see fig. 11 and 12. The principal rafters of a roof may derive considerable strength from being treated in the way shown in this last diagram, which combination is calculated for roofs of 50 ft. span; by this arrangement of the principal rafters at distances of 10 ft. apart, no intermediate stays or posts are required to support the purlins, so that a fine clear span is left in the roof. The tye beam in the diagram is also slit according to Mr. Laves' system, and acquires sufficient stiffness to support itself, without being tied up to a truss. In applying the system to ladders, each of the sides is divided in two parts to within a short distance of the ends, and are there bound together by iron bolts and straps. The intermediate stays and the others, used to keep open the cut also serve to combine the forces of the two parts and being continued are useful to receive a side cord, as an additional security to a person ascending or descending. A ladder so constructed may be placed in a horizontal position, and is sufficiently stiff to act as a temporary bridge or scaffolding, from the window of one house to that of another, on the opposite side of the street, or from one vessel to another. If the chain employed be of iron wire, it would answer the purpose equally well, and be lighter. Should it be desirable to place the ladder in a slightly inclined direction, without any immediate object to rest against, two props or supports might be placed against the uppermost rail or round, and, to avoid oscillation or bending, should also be composed of slight pieces of timber, sawn down the centre, and kept apart by small intermediate blocks, in the manner already described. Ladders on this system, of the height of 50 ft., are at present used in the gardens of Hanover, and moved with great facility.

The following are a few of the works which have been executed after Mr. Laves' system.

Fig. 10, a roof over the riding school of Mr. Grünewald, at Hanover, span 50 feet in the clear, length 116 feet.

Fig. 11, a roof, in wood, of 50 feet span, over a barn belonging to the Baron of Wangenheim, at Wangenheim, near Gotha.

Fig. 11 *a*, a common rafter of ditto.

Fig. 12, a roof over the scenery painting-room at Hanover, covered with a mixture of clay, tar, and pitch, span 38 feet in clear, and length 74 feet.

Fig. 13, a bridge, in fir, for foot passengers, at Celle, near Hanover, constructed with three trusses, span 36 feet, width 7 feet, cost £14.

Fig. 14, a bridge, in oak, for foot passengers, and a water pipe, at Dernebourg, near Hildesheim, span 30 feet, width 10 feet, cost £26.

Fig. 15, a bridge, in iron, in the park of the Count of Munster, at Dernebourg, near Hildesheim, length 42 feet 6 inches, width 4 feet, weight of the centre part is 514 lbs., the span being 27 feet 6 inches; it cost, without balustrade or roadway, about £10.

Fig. 16, a bridge, in iron, for foot passengers, at Salzau, near Kiel, span 22 feet 6 inches, width 6 feet, weight 480 lbs., without balustrade or roadway, cost about £10.

The above are a few of the numerous works which have been executed by the talented inventor on the continent. In another number we purpose giving some examples of bridges of much greater magnitude, which have been executed upon this principle, for which we have not been able to find room on the present occasion. We understand a patent has been granted to Mr. Laves, in this country, for the invention, and a more useful discovery, or one more likely to benefit the community at large, for the facility it presents of constructing cheap lines of communication, we have been seldom called on to speak. We unhesitatingly recommend the principle of Mr. Laves' to the attentive consideration of our readers.*

THE KENTISH COAST.

This coast, but more especially the portion of it extending from the North Foreland to Folkestone, offers a most valuable subject of study for engineers, especially in that most difficult department of their important and varied profession, the forming of harbours or embankments, where they have to contend with the sea invading and demolishing the land. This valuable study, or rather physical school of marine engineering, is easily accessible by young engingeers of the metropolis. The steam ships, either of the Commercial Navigation Company, or of the General Steam Navigation, which by the way are rivals, but rivals in nothing save who shall carry passengers most safely, comfortably, and

* The agent appointed by the inventor, in this country, is Mr. Thomas Meyer architect, of Lincoln's Inn Fields.

speedily, will, under favourable circumstances, waft them from London Bridge to Ramsgate, the most delightful watering place on the Kentish coast, in a little more than six hours and a half, though the distance, as the steamer sails, is more than 72 miles. Of these safe and commodious vessels the fastest, at the present time, is the Duchess of Kent, belonging to the Commercial Company; and, we believe, that the Kent, a smaller vessel, belonging to the same Company, is second on the list. This interprising company, we farther understand, are at present, preparing an experimental boat, with rather a new combination, as the means of propelling it; and it is confidently hoped that the speed will thereby be greatly increased without any increase of danger, and with very little turmoil of the water, inasmuch as there will be no paddle-boxes, which are not only the most unsightly, but the most insecure parts of a common steamer, as they are not only liable to be injured themselves, but also to injure others. When this boat is ready for trial, we shall be enabled to communicate some notice of it to our readers, but to attempt any account of it just now would be premature, and the statement itself would be garbled and imperfect.

Suppose the engineering student to be conveyed to Ramsgate, the first thing that will naturally attract his attention is the harbour at Ramsgate. This is a very fine specimen of aquatic masonry; but, from first to last, it has been a most expensive one; and it is exceedingly doubtful whether the advantages derived from it are at all commensurable with the expense. It is a mere tide harbour, with a scouring basin in the landward part, and it has the adjuncts of a building slip and graving dock. The piers, more especially the eastern or left hand one, as one looks from the town, as a piece of masonry, is very substantial, and does equal credit to the eminent engineers, Smeaton, Rennie, and Sir John Rennie, by whom it was brought to a successful conclusion, notwithstanding the angry sea with which they had to contend, and which, at some stages of the operations, threatened to demolish the works as soon as they were constructed. Drift sand, at the first, filled it up very rapidly, but this was obviated by the erection of the cross wall and sluices, by means of which, the inner harbour is converted into a scouring basin. At first, however, the constructing of this basin was likely to render the cure as bad as the disease; for, in violent weather the sea sets so strongly into the outer harbour, and the water there was so turbulent, that the craft were in danger of being broken to pieces. This again was got the better of by carrying out the eastern pier to a considerably greater length, giving it a bend to the westward, and raising it to a great height. This pier, the terminal part of which was built by the diving bell, was, we believe, among the first applications of that convenient apparatus to building in deep water. Since the east pier was thus extended and elevated, the water in the outer harbour is not nearly so turbulent; and the fury of the sea breaks on the head of the western pier which thus stands in need of frequent repairs. The steamers and other craft frequenting the harbour can now lie securely under the shelter of the eastern pier; but it is too high for being at all commodious for ordinary traffic; and in most states of the tide the ascent and descent render it a little awkward even for the steam-boat passengers. No one can blame the engineers who were employed in its construction; for they had many difficulties to contend with, and overcame them all; but it is a grave question whether there is another harbour in Britain, of which the expense of construction has borne so high a ratio to the real usefulness; and this is a point well worthy the attention of young engineers, whose object ought always to be so to study matters as that, when they afterwards come to be employed, they may keep the expense and the usefulness as nearly upon an equality as possible. When this harbour has been carefully examined, the attention of the student may be directed to nature's own engineering; and he will not fail to observe that, along the whole line of coast, the sea and the weather are assailing the high cliffs, and carrying the debris either to the banks in the offing or to those in the southern part of Pegwell Bay. The materials of those cliffs are of very tender character, consisting either of chalk with many vertical fissures, or of soft tertiary materials, such as those that occur at Pegwell, upon which the sea is committing even more rapid havoc than upon the chalk, though the materials there do not fall in such masses, but are at once disintegrated and washed away.

The action of the sea and the weather upon shores of different characters, though a very simple matter, is one well worthy the attention of young engineers, who may, in the course of their after practice, be called upon to execute harbours, embankments, or other marine works. It will also be observed that it is the bold and cliffy shore which the sea and the weather invariably assail, and, unless the materials are of the most stubborn character, they give away. The roll of the waves, and the current of the wind, beat directly against the bold shore; and, if the cliffs are nearly perpendicular and of considerable height, the stroke is much severer than one would at first be apt to suppose. It is to be borne in mind that the downward pressure of the atmosphere is somewhere about 14 pounds on the square inch, and that both the water and the wind which impinge upon the cliff are held down by this in addition to their own weight. The wind which strikes the cliff when the gale sets against it, is thus condensed, and strikes far more forcibly than that of the air, which, with the same velocity of gale, passes freely inward on a flat and level coast: and this condensation of the air also presses down the water and makes it assail the cliff with more than ordinary violence. These are the real causes why the bold shores are those which the sea invariably assails; and the same thing, though to a smaller extent, of course, may be seen in the banks of rivers; for rivers invariably cut away the high bank, and generally throw the debris upon the low one opposite.

In order to have a good general understanding of this coast, the young engineer must attend to the tides; for many of its most striking peculiarities depend upon them. Somewhere upon the east coast of Kent, but varying in locality with the state of the weather, there is a point of confluence, or of the meeting of two tide waves which come in opposite directions. These are the south tide, which comes in directly from the Atlantic, and sets up the English Channel; and the north tide, which parts from the former at the south-west of Ireland, and, proceeding northward, rounds the north of Scotland, and moves southward along the east coast, until it reaches the estuary of the Thames, on the southern shore of which it is met by the channel tide. If the wind is at south-west, and blows strong—which it often does in the channel—the channel tide gets the mastery of the north tide, which is diminished by the very same wind which increases the channel one; and, under these circumstances, the channel tide rounds the North Foreland, and sets to a greater or less distance up the estuary of the Thames. On the other hand, if the wind is strong at north-east, which it often is at certain seasons of the year, in consequence of the proximate part of the continent being colder than England, the north tide gets the mastery of the south one, and may advance upon it as far as the South Foreland. These circumstances not only render the tides a little uncertain upon this part of the coast; but the confluence of the two tides produces a sort of ridge in the water, which strikes more forcibly against the land than if a single wave of high water were proceeding uninterruptedly along the shore. The result of this is a greater tendency to disintegration of the land.

In ordinary states of the weather, Deal and the North Foreland have high water at the same hour, that is at fifteen minutes past eleven in the spring tides at full and change of the moon; and, therefore, we may conclude that, as the high water at Deal is the channel tide, and that at the North Foreland the North Sea tide, the point of confluence must be about midway between those places, that is about Pegwell Bay. No doubt this varies with the weather, as has been already stated; but still Pegwell Bay may be taken as about the average in all weathers. Wherever there is a confluence of tides, there is a tendency to deposit such earthy matters as the waters hold in suspension; and it is this tendency to depositation here which has in the course of time filled up the channel which used to divide the isle of Thanet from the rest of Kent; and the materials that nature has employed for this purpose have been obtained by disintegration of the cliffy shores, in the same manner as the disintegration of the isle of Sheppey and the adjacent coast is filling up the channel between that island and the main land. These are the general principles of tidal action on the east of Kent; but he who wishes so to understand them, as to turn them to account for engineering purposes must make his own observations on the spot.

If the observer proceeds southward, and especially if he gets beyond the South Foreland, a new species of action will attract his attention. Instead of sand or sludge, as occurs on the beaches and the bays farther to the north, he will find the strand covered with a great mass of loose shingle; and by taking up and examining the

pebbles of which that shingle is composed, he will find that comparatively few of them are flints, or any other species of stone found native in the Kentish strata. Very many of them correspond with the rocks of Cornwall, Devon, and Dorset; and it does not require to be pointed out that these must be carried eastward by the channel tide. They form what is called "the shingle drift" of the channel, which is a regular motion of pebbles inward, going on at all seasons and at all states of the weather, though of course most strongly when the waters of the channel are agitated by strong winds from the south-west.

This drift of shingle or pebbles has ruined, or at least greatly deteriorated, most of the harbours on the south coast of England; and it is an enemy with which even the most skilful engineers find it very difficult to deal. Its progress has been attempted to be arrested by jetties carried a considerable way into the water; but the pebbles always contrive to get round the points of these, and even to overleap them, if the water is strongly agitated and the wind blowing from south-west or in the direction of the drift. Several observations have been made, and various tracts written on the subject of this shingle drift, but the knowledge of it seems far from perfect; and it demands a more thorough investigation than it has hitherto received. Its progress from the western counties is not along the line of the beach; for it only appears or accumulates there where there is an inbend of the coast open to the south-west. The most remarkable accumulation of it is the Chesil bank, to the westward of the Isle of Portland, and extending for a good many miles north-west to St. Catherine's chapel. At this part of the coast it forms a detached bank or beach, having two portions of sea, called the East Fleet and West Fleet, between it and the land. How the shingle gets round the Bill of Portland has not been so thoroughly examined as the importance of the case requires; but there is no question that it does get round, and that considerably to seaward. Upon the Chisel bank itself the sea breaks with great fury in strong gales from the south-west; and there have been instances of vessels thrown right over the top of the bank where it was considerably above the high water line. From the Bill of Portland eastward to the Isle of Wight little of the shingle makes its appearance in shore; the bays there, especially that of Christchurch, having shores of soft tertiary strata, which are in a rapid state of decomposition by the action of the sea. The shingle again makes its appearance at the entrance of the Solent, in the long beach at the extremity of which Hurst Castle is situated, and also at some shifting banks between this beach and the Needles. Within the Needles, there is shingle on the Isle of Wight shore; but it does not bear evidence of being so much subjected to friction as the drift shingle, and the deposit on the opposite coast of the New Forest consists chiefly of sludgy matters, resulting from the decomposition of the tertiary strata farther to the west, and also of those at Alum Bay.

At the back of the Isle of Wight, to the eastward of the chalk cliffs, some shingle accumulates in Chale Bay; but the quantity there is not very great; and it does not drift along the shore, as it does in some parts of Sussex and the south-east of Kent. The long ledge of rocks which extends into the channel from Rocken end at the western termination of the Undercliff, throws the shingle drift to seaward, in the same manner as the similar ledge which occasions the "race" or turbulent water off the Bill of Portland; and though there are some stony beaches, alternating with the broken rocks of the Undercliff, the shingle drift in its mass does not again touch the island, but moves up the channel at some distance to seaward and only comes upon the shore in quantity so far up the channel, so that the retarded extremity at the flood-tide we have mentioned broaches right in shore.

When the vicinity of Dovor is reached, a somewhat different state of things occurs. The channel there is considerably narrowed, and this by the flexure northward of the coast of France. In the lower part of the channel, the tide on the French coast rises much higher, and runs with more impetuosity, than on the English coast; and this may be one reason why the shingle drift is kept farther to seaward; but as Dovor is approached, the peculiar form of the French coast deflects the tide wave towards England, and that of course brings the shingle drift along with it. If the passage of this tide were clear into the North Sea, the shingle would drive along the shore at Dovor; and be carried into the estuary of the Thames, and probably to the northward of that estuary. But as we have already mentioned, the tide from the North Sea meets it somewhere between the Forelands, or northward or southward, according to the state of the weather; and by this meeting the force of both tide waves is weakened, so that no drift of shingle is carried past, or even exactly to, the average line of contact. Here the suspended materials are parted, one portion being carried to the sands in the offing, and the other to the sludgy beaches in Pegwell Bay, and the sands to the south; and, as there is a constant disintegration of the cliffs both to the northward and to the southward, the accumulations in those places are in a state of continual increase. Up to the line or point of convergence where the one tide meets the other, that which comes from the north clings to the British shore; and is weaker beyond the banks, and hardly felt at all, outside the Goodwin. Thus the the channel tide, though extinguished by the North Sea tide, immediately in shore, yet turns round that tide in the offing, and sets northward to the continental shore, until it is extinguished somewhere near the entrance to the Baltic. In consequence of this, there is a line of convergence of tide lying obliquely along the North Sea, from near the Goodwin, to near the Skawe in Jutland; and, as there is always slack water, that is water which moves neither way in a tide current, at every point and line of convergence, it is along this line that the dogger and other mud-sea banks are formed. This line is of course not constant in its position, but varies its form according to the relative force of the two tides. In the more northerly parts of the sea, the north tide is the more powerful one, and presses the tide from the channel eastward to its final extinguishment on the Danish coast. But, in the southern part, the channel tide is the stronger, and presses the North Sea tide to its final extinguishment on the British coast. On this account the line of confluence, and consequently of depositation, takes that position which we have stated.

Close in to the British shore there is a sort of loop of confluence, which is convex towards the weaker tide and concave towards the stronger; and as the temporary strength depends upon the weather, the flexure of course has sometimes the one way, and sometimes the other. Also, when the two tides are not of equal strength, the stronger one always arrives at the given point before the weaker; and thus there may be something like a double tide, though upon this coast the indications of that are very trifling. It is a great advantage to the roadstead at Deal, that it should lie near the average point of confluence of the two tides; because vessels moored there cannot drift either way by a strong tide wave, and thus have to contend only with the wind; and it may not be irrelevant remark that the roadstead at Spithead stands pretty much in the same circumstances.

The brief notice which we have given of the general set of the tides along that part of the British shores, of which the east of Kent is the centre, may be considered as an index to very extensive and essential knowledge, which ought to be possessed by every one who ventures to practise, or even to recommend, marine engineering upon this very peculiar portion of the margin of England. In the northern part, Ramsgate Harbour is, we should suppose, experiment enough; but a question has lately been mooted, and some observations have been made, with a view to the constructing of harbours, or a harbour, of refuge, at Dovor, or somewhere to the south-west. The form of the shore, the depth of water in the offing, and the height of the cliffs, render Dovor one of the most eligible points for such a harbour; and this eligibility is increased by some other circumstances, both existing, and in prospect. Dovor is the oldest port from which passages to and from the continent have been made; the sea voyage is shorter than anywhere else; and these are circumstances which any traveller can appreciate. Then again, the South-Eastern Railway is in progress, and by means of it, both passengers and goods may be landed close to Dovor harbour. It is therefore desirable that this harbour should be made as safe, as commodious, and as likely to remain without change in its entrance, as it can possibly be made. There is just one obstacle to be overcome; and that is the shingle. At present, scouring basins, and various other contrivances have been resorted to, for controlling the march of this enemy; but we are bound to say that, in proportion to the expense, the success has not been very great.

The cause of this cannot be charged against the engineers, as constructors of works; but it seems to be a grave question, whether any of them has thoroughly studied the nature and operation of the

shingle drift, the grand enemy with which they have to deal. If this drift is merely along the shore, extending but little to seaward, and not in anywise getting into very deep water, then the construction of a pier of sufficient length and strength, would arrest it at least for a time; and a proper direction given to this pier, might deflect it, so that, from the peculiar set of the tides at Dovor, it might perchance be transferred, in part at least, to the Dogger bank, or other slack-water deposit in the offing. This, however, is mere hypothesis, and very vague hypothesis; for the length, strength, and position of the pier which would best effect the object, are all indeterminate quantities; there never having been an efficient pier constructed under similar circumstances. The pier at Ramsgate appears to be long and strong enough for preventing the drift there from getting round the pier head; but the drift of Ramsgate is sand, in no great quantity, and brought by a tide which is not only weak and near its extinguishment, but which is often turned the other way. The pier at Aberdeen is also long, and has been very expensive; but the drift there is also sand; and, notwithstanding the expense that has been incurred, we believe there is still a tendency to the formation of banks, which renders the dredging-machine necessary; while the accumulation of sand to the northward of the pier, and the undermining produced by the outfall of the Dee on the south side, make it by no means secure against the casualties of strong storms from the north-east. The shingle at Dovor is a much more serious matter to deal with than even the sand at Aberdeen; because, when the water is much agitated, the shingle pebbles actually leap along, and will sometimes contrive to overleap considerable heights, as may be seen at the Chesil bank, or even at Dovor itself. The chance is therefore, though a pier were carried seawards beyond the range of the present drift, that drift would not move outward to the extremity of the pier, but form a shifting bar across the entrance to the harbour, much in the same way as it does at present. Were this to be the case, the cure might be much worse than the disease; because no scouring basin could open even a temporary passage in a shingle bank so far to seaward; and the result may be that immediately across the mouth of the harbour, the bar or bank might, in time, accumulate to above the high water mark, as the banks near the Needles have done — or at least sometimes do, for they are subject to temporary variations; and then farewell to the harbour at Dovor — and for ever. A careful inspection of the harbours to the westward, which have been changed or destroyed by the shingle drift, and a judicious investigation of the causes, would be most essential preliminaries before any large sums were expended at Dovor, by any party or parties whatsoever.

But the most serious point remains behind, namely, whether the shingle does not broach to upon this part of the coast, from a far greater distance to seaward than any pier could conveniently, or even possibly, be extended. Should such be the case, the choking up of the harbour would be much more rapid. In the construction of harbours, unnecessary expense enough has been incurred through want of the requisite information at the outset; and, therefore, it would be well to impress upon all who may be concerned in any future one, the importance of the maxim "Learn and thence do."

Dovor castle, though not a piece of civil engineering, is yet well worthy of inspection, as displaying a compound of many styles of fortification, the parts of which are not always in the best keeping with each other; but yet it has a very picturesque and imposing effect, as a whole.

Notwithstanding the celebrity which it has received from the gorgeous description of the bard of Avon, there is not much to admire in Shakspeare's cliff; for when one has said that it is a great lump of tender chalk in the progress of demolition, one has exhausted nearly all that can be said about it. At present, however, it has a temporary interest to the young engineer on account of the tunnel which is making through it for the accommodation of the South Eastern Railway. How the portion of the railway to the eastward of the tunnel entrance may stand we shall not pretend to say; but it would have been more secure had it been at a greater distance from the sea. The sea wall which supports it may be stronger than the natural sea cliff; and it is lower, and consequently not so much exposed to the weather; but still, in a situation where the sea and the weather are rapidly demolishing the natural cliff, we should have considered twice before we had put up a sea wall of nearly the same materials. The plea perhaps is, that the contractor must "build the place of such turf as he has got," but this is no good plea in a work of such a nature as a railroad.

Two portions of tunnel are required here; one through Shakspeare's Cliff, and the other through the more westerly cliff towards Folkestone. Between these the line will again lie near the shore, open to the weather; and thus, without great skill and expense, there will be some danger of its not being durable. We have not seen the more westerly tunnel, and we are not aware that it is begun: indeed we cannot say that we have *seen* the Shakspeare Tunnel, but we have groped through it, and got a glance of a good many parts. The idea of it is good, and it would be premature to say much of the execution. It is double, or consists of two galleries, one for the down trains, and the other for the up; and we suppose the partition between them is strong enough to bear the collision of a train, if any casualty of the kind should happen. If such a casualty shall occur, and the partition shall not be found sufficiently strong, then the catastrophe will be much the same as that which ensued in the house of Dagon, when Samson, having laid hold of the two pillars, said, "Let me die with the Philistines, and bowed himself with all his might." Engineers would do well to remember that those who have the conducting of railway trains have, in some late unfortunate cases, shown that they are sometimes not so quick-sighted as they should be, and therefore they should take care that the chances of casualty are as few as possible. We have no doubt that, in the case under cousideration, the engineer made quite sure of the stability of his materials to bear the contact of any train; but still it would have been as well if these two galleries had been a little farther apart. The tunnel is yet in too imperfect a state, however, for allowing one to come to any positive conclusion respecting it.

Still, as a piece of engineering, it is well worthy of attention, because there is something novel about it. The excavated materials are not drawn up, but shot into the sea along branch galleries which lead to the face of the cliff; and as one gropes along, the glimmers of light which appear at the extremity of each of these galleries has a curious appearance.

All this tunneling must be very expensive work, and on this, and also on account of the small probability that the line will ever be a commercial one, we have heard objections grounded to the work altogether. Now, there can be no doubt that the line will benefit that part of the country through which it passes, — a part by the way which stood much in need of something of the kind. We have heard it urged against the South Eastern Railway that there is not now, nor is there likely ever to be any great trade at the port of Dovor; and that, therefore, very little can be expected from the carriage of goods along the line. We do not think there is much force in this objection; because, unless under peculiar circumstances, and even then to a very limited extent, the carriage of goods upon railways can never be looked to as a source of any great emolument to the proprietors. The country is not so necessitous in these articles, as to require that saucepans, ploughshares, or bales of goods, should travel at the rate of twenty or thirty miles an hour; and, therefore, the regular distribution of commodities over the country, especially weighty ones, will continue to be made by cheaper and slower means of conveyance. The only large traffic which the railways can expect in this way is the carriage of sheep and cattle to London and other places of great demand. In the case of these, there is a saving in various ways. Driving the animals for long distances is expensive, both for attendance and for keep by the way; and in the case of fatted animals, the quality is much deteriorated by driving. In the case of them, therefore, a moderate charge for the railway carriage, must be a real saving to the owners, and a great advantage to the public in obtaining more wholesome food. Fatted beasts cannot, without sustaining material injury, be driven farther in a day than a railway can carry them in an hour; and thus they may be brought in good condition to market, in the course of twenty-four hours, from distances where driving would at least occupy three weeks. Now, the South Eastern Railway passes through an agricultural country, and one which, in the greater part of its extent is well adapted for the growth of turnips and the fattening of sheep. Therefore, there cannot be the least doubt that this railway if once in full operation, and duly appreciated, will greatly increase the agricultural value of the county of Kent.

Independently of the transit of passengers, by means of which a

vast saving of time and expense is effected, and the people of different parts of the country brought into far more frequent and valuable intercourse than they ever were before, we are inclined to look upon the agricultural advantages of railways—that is long lines of railway as being far the most important. Very many parts of England are not cultivated up to half, or nearly half, the capabilities of the land and the climate, just because there is not the stimulus of a readily accessible market. This applies in an especial degree to animals, and yet more to fatted animals; and we need hardly say that, if the number of these in any district is deficient, the land will be starved from want of that nourishment which they alone can furnish to it, and the grain crops will be deficient also.

We admit that agriculturists, not having those excitements about them which the manufacturing population possess, are comparatively slow in availing themselves of any improvement, how much soever it might conduce to their advantage; but still, from long and attentive consideration of the subject, we are well convinced that the opening of all the markets, even to very remote districts, by means of the system of railways, is one of the greatest advantages that was ever offered to the agriculturists of our country. So great does it appear, that it ought to draw the attention of the proprietors of land; and we feel quite convinced that if the nobility and landed gentry had been duly awake to their own interest, they would not only have presented the railway companies with the land requisite for the lines, but would have given them a bonus in addition. In the vicinity of towns, and in the case of small properties, this could not be expected; but there are many large estates in the country, the leading of a railway judiciously through which, might, in very few years, add five and twenty per cent. to the actual produce, and even more than that to the rental; because the richer that a farm is, the returns are always the greater in proportion to the annual expenditure; and we are quite sure that there are many farms in England, where, if the farmer had the advantage of such a stimulus, and availed himself of it, and at the same time had the security of his lease, he might grow more than his rent, in addition to what he now grows, without being at any more expense.

This is, perhaps, a new view of the national advantage of railways; but, at the same time, it is an important one, and one which is demonstrably correct—and it only wants perception, energy, and activity on the part of land owners and farmers to afford the practical demonstration in a way the most advantageous to themselves, and the most beneficial to their country.

Still, however, no transit of agricultural produce that can be expected could support an establishment of this kind. The railway must depend mainly on passengers; and according as these are numerous, agricultural produce can and should be carried at less expense. Now, in the matter of passengers, we cannot see that there is any reason to despond in the case of this South Eastern line. Dovor will always command its full share of intercourse between England and the continent; and when the facility of a railway is added, there is no doubt that the intercourse will be greatly increased; and a portion of the advantage will go not only to every town near to which the line approaches, but to the whole district along which it passes. No doubt this, and all other lines which lie in directions where there used to be a great deal of coach-travelling, will injure those small towns and villages that depended almost entirely upon the horsing of coaches, and the supplying of travellers with refreshment. But to the country, and even to the district, taken generally, this is a good and not an evil; for, though a number of persons and families may have been supported by these means, their support was a direct loss to the public. The sums which are thus saved will not be hoarded; but will go to stimulate and reward some more usefully productive class; and, thus, what was wasted in mere expenses will be employed as active and productive capital.

Many of the points touched upon in these remarks are well worthy of attention, both in an engineering and in a national point of view,—if, indeed, those views should be separated, which we rather think they should not, because in every great work, the permanent advantage of the public, and not his own private advantage, either in the way of honour or emolument, ought to be the grand ruling principle with every engineer. But we have reached our limit, in the mean time, and we believe we have touched upon most of the subjects that should peculiarly interest a young engineer who visits and examines the Kentish coast.

SURVEYING.

"A TREATISE ON ENGINEERING FIELD-WORK, SECOND EDITION. BY PETER BRUFF."

This is a very plain and simple, and in most parts perspicuous, work, and cannot fail in being useful to those who are studying the subject. The great aim of Mr. Bruff seems, indeed, to give his production so much plainness, both in subject and in expression, as that those having very little mathematical knowledge, and scarcely any knowledge of surveying, might be able thoroughly to understand it. It is divided into six chapters; the first is very short, simply giving a definition of the word "surveying," measuring straight lines, and taking offsets. The second contains an explanation of chain measurement, in taking the dimensions of small surfaces, surfaces where no line can be measured across, and of roads, and also of reducing lines of varied elevation to the horizontal level. The third treats of more extensive surface measurements, the errors to which the chain-measurement of them is liable, their various details, and some remarks on field-books. The fourth contains accounts of parish surveys, remarks on the improvements made by the tithe commissioners—the which improvements we have great doubts of, the laying down of such surveys, and examples of railway surveying. The fifth chapter treats of the very simplest use of angular instruments, of the surveying of lawns, of underground surveying, of surveying coasts and harbours, and of various other matters. And the sixth consists of remarks on protracting angles, plotting surfaces, calculating areas, reducing and copying plans, instruments and their uses, and concluding remarks. In the course of these chapters, various wood-cuts, lithographic, and engraved illustrations are introduced.

We have said that the book is exceedingly simple, easily understood, multifarious in its subjects, and for these reasons it must be very valuable to tyros in the craft. But—for when reviewers we are entitled to our "but," its principal utility is confined to such; otherwise, the art of surveying is at an equinoxial spring tide in England; and, certes, from results which we have seen, and which others have felt to our cost, this appears to be really the case. We cannot, of course, know the number; and we do not personally know one of the units that, as a certain honourable gentleman would say, "make up the tottle of the whole;" but we have heard of Mr. Bruff as a man of information, judgment, and experience, and thus we are quite certain that he is not one of the "units." This book, too, has arrived at a second edition in no very lengthened period of time, and therefore it must be just the kind of book which is wanted by the profession to which he belongs.

Having said thus much, we may return to our "but," because it may be within the limits of possibility that the few words which we say concerning it may be useful.

In the first place, then, taking only the present volume, the title is a misnomer. The book does not treat of the theory of surveying, but only of the practice, and that in a very simple manner. Even when the second part makes its appearance, the title will still be a misnomer, because, according to the notice given in the present volume, it is to contain "an elaborate treatise on levelling," which is the business of the surveyor, and not of the engineer. To determine the form of an undulated vertical line is exactly the same thing as to determine that of a crooked horizontal boundary; only, as the very heaviest surveyor cannot get down into the solid earth to measure his offsets from the curve of its mean elevation, he must have recourse to the levelling instrument. Still, however, this is no more than every surveyor who surveys accurately ought to do with every line that he actually measures or delineates in his plan; because there are many important duties connected with a practitioner of common land surveying, or of road surveying, if the one or the other is performed as it ought to be, which depend upon this very circumstance. As straight lines measured for areas, and lines of mere length measured for roads, or for any other purpose where a line only is necessary, are curves of single curvature; so crooked lines in a surface survey, and crooked lines of road when the surfaces across which they pass are lines of double curvature, if the proper use of them is to be made; and if the surveyor does not furnish data for arriving at this use, he performs only half his duty, and ought not to belong to the profession.

This brings us to the second deficiency of the work before us; or,

rather, to the imperfect definition which at the outset it gives of the operation of surveying. Now, if the object of the survey is merely to ascertain the extent of surface, and to reduce that surface to a plain one having the same boundaries, so that it may be mapped on a plan, this is not surveying; it is merely measuring. So also in the case of a road, if the mere length and position of the line are all that are determined, the work is still only half done—indeed, not even that. Farther, if in the case of a railway survey, that is, a survey upon which the engineer is to ground his estimates, and have the work completed for within or under the amount of those estimates, then the ascertaining of the double curvature, namely, the lateral flexures and the difference of level, only a small portion of the duty which he ought to do is performed. We call particular attention to this point; because, though there have been sad bunglings in the levels of some railways, in consequence of which considerable portions of them have been thrown up into the air in the sections, and the engineers and contractors have had to get them down to *terra firma* as they best could; it is in the matters which the surveyors appear to have totally overlooked that the great blunder has lain, and by these that the millions of expense, unexpected at first, have been incurred.

The third omission—arising, no doubt, from the same cause as the others—and the last one to which we shall allude, is the total want of even an allusion to trigonometrical or any other calculations in which logarithms can be employed to shorten and simplify the processes of calculating. No man ought to be a surveyor, even on the humblest scale, without a thorough knowledge of trigonometry, and a ready use of the logarithmic calculus; because both of these not only shorten his time but render his results far more accurate. A good trigonometer has resources in the field which cannot be possessed by any one ignorant of this delightful branch of elementary geometry; and the ready use of logarithms is equally essential in the office. Mr. Bruff, however, must well know the calibre of those for whose use his book is intended, and he may have thought that they were either so thoroughly learned in these matters, or so totally ignorant of them, that their introduction was unnecessary.

Before we proceed to the serious matters, which are those involved in the second omission to which we have specifically alluded, we may mention a few less important desiderata, which it would have been as well to supply. First, there is the operation of "taking and giving," by means of which an experienced surveyor can find areas with a fraction of the usual trouble, and yet come as near the truth. Secondly, there is the obtaining of an equilateral triangle, by taking up a single link of the chain and extending the other ninety-nine in thirty-threes upon three arrows, which is the best way of clearing an obstacle that intercepts the progress in a line of chainage. Thirdly, there is the method of equidistant ordinates, which, though, like the taking and giving, it requires some judgment, is a great means of simplification. Fourthly, there is the accurate reduction of an ascending or descending line to its horizontal base, which is always best done by trigonometry. Fifthly, there is the allowing for the "spherical excess," which is a matter of great importance in the lines of verification, when a surface survey is of great extent. Such lines, if they are of any considerable length, ought never to be measured by the chain, but deduced by triangulation from an accurately determined base; and, as all triangles on the surface of the earth are spherical triangles, of which the three angles amount to more than two right angles, the excess ought always to be allowed for, if the lines are of any considerable length. Sixthly, there ought to have been some notice of the means of reducing a triangle of double obliquity to the horizontal plain. Besides these there are a few other matters connected with the simple processes of measuring lines and determining areas, which are of more use in important surveys than many are apt to suppose.

The gravamen of the whole matter, upon which, however, not the slightest accusation is meant to be brought against Mr. Bruff, lies in the total omissions involved in the second leading point to which we have alluded; and these apply equally to surveyors of estates, of common roads, and of railroads. In each and all of these cases a surveyor can furnish information which cannot readily be obtained by any other party. In the surveying of land there should be something more than mere measurement; for the accomplished surveyor ought to be able to tell the value of that land as depending upon its geological character, its elevation, and its slope; because these are important elements in the knowledge of its worth, whether it is to be purchased, or be taken on lease for farming purposes. In like manner, a judicious surveyor of a new line of road, or of an old one to be improved, ought to return, along with the survey, an account of all the ups and downs, and varieties of soil, over which it is intended to pass, and of the situation and quality of the materials which are likely to be used in its construction. A railroad surveyor gives, according to the measure of his ability, the ups and downs of the line; but the information which we are not aware of any such surveyor having in any one case given is of far greater importance. He ought to return an accurate account, from the most careful observation, of the nature of the soil through which every cutting is to pass, and of that of which the requisite embankments are to be made. It may be supposed that these matters are the business of the engineer; but the fact is not so. It is, or at all events it ought to be, the business of the surveyor to furnish all the requisite observation as to the kinds of strata through which the line has to be carried; and, besides this, though it is not so especially binding on him, he ought to be able to return an account of the degree of slope at which the banks of every yard of the excavations and the embankments will stand secure in the most trying weather which the line is likely to experience.

These may, in each of the three cases to which we have alluded, appear to be severe labours for the surveyor, and no doubt, as long as surveyors are mere measurers and nothing else, information so valuable could not be expected at their hands. But regarding, as we do, the surveyor one of the most important of the three professions, we think that he ought to be capable of doing these things; that he ought to do them, and be remunerated accordingly, for we are well convinced that half the losses and failures which have occurred in public works have been owing to the employment of incompetent men at small salaries, in this department. How the evil is to be remedied we do not exactly know; but we would say, in the way of experiment, "LET US HAVE AN INSTITUTION OF SURVEYORS."

RAILWAY SUGGESTIONS.

SIR,—It is painful to observe the frequent accidents and loss of life to travellers on railroads, arising, not unfrequently, from neglect or inattention: my object, however, is, not to throw reflections on any party, whether commanding or obeying, but only to hint some suggestions tending to diminish accidents of this description, and which, I trust, will be considered a sufficient apology for the intrusion I make on your valuable journal.

In the first place, I will suppose a double track of rails laid down firm and secure, and to be always kept in that state. Secondly, travelling in opposite directions on one track of rails should never, on any consideration, be allowed. Thirdly, Station places should not be erected in, or immediately on, the entrance of a curved excavation, nor on the commencement of a curve passing a hill, but, if unavoidable, a side road, or branch of rails, should be provided, and no stoppage on the main road, in such places, be permitted. It is almost needless to add that the care of the shifting points on such station places should be entrusted to careful and attentive persons, and no others. It appears to me that such men as have by accident lost a leg or an arm, or are otherwise unfit for general employment, would be the fittest persons for this service; at the same time it would afford such unfortunate sufferers the means of subsistence, inasmuch as the fear of losing their almost charitable employment would have a tendency to keep them attentive, when others have nothing more serious to apprehend from neglect of their duty than a discharge from their employment, which may soon be recovered by an engagement elsewhere, which in the former case is not so easily obtained. Fourthly, each locomotive engine should be provided with a lantern, always lighted in foggy weather or at nights, sufficiently elevated to be seen in all directions over the carriages, from behind as well as in front of them; such lantern might be suspended immediately below the top of the chimney, one in front and another behind; the care of these lanterns would, of course, be with the engine driver, who at his peril would not forget to pay due attention to his signal.

Through one of these oversights not being attended to, a most

destructive collision happened about two years ago, on the opening of the North-Vienna railway, where several lives were lost, and a great number injured. The accident took place from the following circumstances. The trains, three in number, left Vienna in the morning, and arrived in Brunn (about ninety English miles north of Vienna) at noon; in departing from Brunn, another train was added for the accommodation of the governor and chief inhabitants of that city, and an engine, not adapted for fast travelling, was attached to this train. For the sake of compliment to the governor, it was ordered to depart first, and the first station place being situated on the termination of a curve passing a hill, and, consequently, hidden from view, except within a few hundred yards, and five minutes only being allowed between each successive train, the first train, being a slow one, having arrived later than expected, the second came up behind it with barely time for stopping with safety; the third coming at a full speed, a collision, more horrible than can be described, took place: the framing of the last carriage of the second train was literally driven on top of the next one; the other parts of the two carriages were shattered to atoms, and their unfortunate inmates presented the most horrible spectacle that I ever witnessed. I, fortunately, had been detained from the second and third trains, and, consequently, had no alternative but to go in the last, to which delay I owe my escape.

If what I have stated shoud meet with due consideration from parties concerned in the management of railways, I have no doubt but accidents arising from collision would be less frequent, if not totally ceasing.

I am, Sir, your's obediently,
G. V. G——N.

October 23rd, 1840.

[Some of our correspondent's suggestions are certainly worth consideration, especially the running on one line of rails from either way, the practice of which, even if only occasionally resorted to, ought most decidedly to be reprobated. We would be answered with a long list of rules and regulations, starting times and arrivals; but we will say that human life is far too precious for such chances and calculations. We do not mean to infer that this is the case on the railway lines generally, it is only resorted to on account of repairs or other contingencies; but our opinion is, and we think it a pretty general one, that in urgent cases the traffic ought to be stopped for a time; and in others at least delayed, to allow for a concentration of force upon any given point. This certainly is a vital subject, and calls for astringent measures. Our writer's views respecting the poor fellows-the-worse-for-accidents being made useful at the stations is indeed a matter of another stamp, and would serve to fill such places with a motley of almost useless personages, or give them the character of curiosity shops. However, we thank him for the care he has taken in noticing the subjects, and recommend the same to our readers.]

PARISH SURVEYS.

Sir,—Accidentally meeting with the last number of your valuable journal, I was induced to purchase the preceding ones, and on perusing them, my notice was particularly attracted by "*A Surveyor's*" letter, which appeared in No. V. It referred to the parish surveys now taking place under the Tithe Commutation act, and suggested that the non-approval by the commissioners of most of the plans submitted to their examination has been occasioned by the low rate at which the surveys were undertaken, and consequent scanting of the work. Undoubtedly the suggestion is in part correct; but I beg to add that there are other reasons connected with their failure besides the difficulties presented by the "Woody dell," or the lack of competent surveyors. The principal one of these I consider to be the uncertainty of the surveyor as to what is required of him, by those to whom the testing of his work is assigned; as the regulations first issued by the commissioners were six or seven in number, and now amount to thirteen or fourteen. Thus, if the surveyor forwards a plan and reference strictly in conformity with the established rules, the chances are, that it will be returned with two or three fresh regulations affixed. This, and the rigidity of the examination to which plans are subjected (and which will be sufficiently proved by the fact of quantities of 9 or 10 acres having been returned for alteration, where differences of only 2 or 3 perches have occurred, between the surveyor's computation, and that of the examiner), must naturally lead to such a protracted business (if not ultimate rejection of the map) that all confidence is lost between the surveyor and his employers, and not unfrequently ends in bringing a good surveyor into disrepute.

Once let the commissioners establish a set of standing rules, subject neither to addition nor subtraction, by which examinations are to be conducted, and the difficulty of getting plans approved will be abolished. Hoping you will do me the favour to insert this,

I am, sir, your obedient servant,
"An Old Practitioner."

Croydon, Oct. 19th, 1840.

ON THE DUTY PERFORMED BY CORNISH STEAM-ENGINES.

[from the mining journal.]

Sir,—I noticed in your valuable journal of the 19th ult., a statement of the experiments tried on several engines in Cornwall, for the purpose of satisfying the deputation from the Dutch Government of the correctness of the monthly reports of duty stated to be performed by the engines in Cornwall. Of the accuracy of these experiments I have no doubt—having myself tried similar experiments, and knowing that a trial made for a short period may exhibit the extraordinary results stated. I think, however, for practical purposes—for the promotion of which your journal appears to be a most strenuous advocate—the average duty performed for twelve months would be a better criterion of the advantages to be obtained by adopting the Cornish system; at any rate, I trust the following comparative statement of the duty performed by several engines, from September, 1839, to August, 1840, inclusive, and the duty done in short trials, will prove interesting to some of the readers of your journal:—

TABLE.

ENGINES.	Diameter of cylinder.	Duty reported as performed during a six hours trial.	Average duty performed during twelve months.	Aver. coals per hour per horse power.	Greatest duty reported in one month.	Lowest duty reported in one month.	Variation in duty.
	Inches.	lbs. lifted 1ft. high	lbs. lifted 1ft. high	lbs.	lbs. lifted 1ft. high	lbs. lifted 1ft. high	per cent.
Fowey Consols—Austen's	90 single	122,731,766	81,068,669	2·28	85,280,207	76,993,755	10 6-10th
Wheal Vor—Borlase's	60 ,,	123,300,593	79,635,345	2·32	85,035,814	73,844,259	18 1-10th
Wheal Darlington	80 ,,	78,257,675	76,371,172	2·43	84,042,418	70,389,546	19 3-10th
Charlestown United Mines	50 ,,	55,912,393	53,758,967	3·51	56,069,046	45,177,420	24 1-10th
Ditto Stamping Engine	32 ,,	60,535,060	54,575,956	3·40	59,589,894	51,140,412	16 5-10th
Wheal Vor ditto	36 double	56,065,568	53,190,264	3·48	56,274,952	48,125,908	16 9-10th
The Cornish Engine at the East-London Water Works, Old Ford, designed and erected by Mr. W. West	90 single	118,523,475 (6 hours trial, April 24, 1839)	77,319,717	2·40	83,999,387	69,785,078	19 2-10th
A Boulton and Watt Engine, on the same works—boiler, cylinder, &c., clothed with Borradaile and Whiting's Patent Felt, and pumps fitted up with Harvey and West's Patent Valves	60 ,,	——	35,809,965	5·20	——	——	——

rather, to the imperfect definition which at the outset it gives of the operation of surveying. Now, if the object of the survey is merely to ascertain the extent of surface, and to reduce that surface to a plain one having the same boundaries, so that it may be mapped on a plan, this is not surveying; it is merely measuring. So also in the case of a road, if the mere length and position of the line are all that are determined, the work is still only half done—indeed, not even that. Farther, if in the case of a railway survey, that is, a survey upon which the engineer is to ground his estimates, and have the work completed for within or under the amount of those estimates, then the ascertaining of the double curvature, namely, the lateral flexures and the difference of level, only a small portion of the duty which he ought to do is performed. We call particular attention to this point; because, though there have been sad bunglings in the levels of some railways, in consequence of which considerable portions of them have been thrown up into the air in the sections, and the engineers and contractors have had to get them down to *terra firma* as they best could; it is in the matters which the surveyors appear to have totally overlooked that the great blunder has lain, and by these that the millions of expense, unexpected at first, have been incurred.

The third omission—arising, no doubt, from the same cause as the others—and the last one to which we shall allude, is the total want of even an allusion to trigonometrical or any other calculations in which logarithms can be employed to shorten and simplify the processes of calculating. No man ought to be a surveyor, even on the humblest scale, without a thorough knowledge of trigonometry, and a ready use of the logarithmic calculus; because both of these not only shorten his time but render his results far more accurate. A good trigonometer has resources in the field which cannot be possessed by any one ignorant of this delightful branch of elementary geometry; and the ready use of logarithms is equally essential in the office. Mr. Bruff, however, must well know the calibre of those for whose use his book is intended, and he may have thought that they were either so thoroughly learned in these matters, or so totally ignorant of them, that their introduction was unnecessary.

Before we proceed to the serious matters, which are those involved in the second omission to which we have specifically alluded, we may mention a few less important desiderata, which it would have been as well to supply. First, there is the operation of "taking and giving," by means of which an experienced surveyor can find areas with a fraction of the usual trouble, and yet come as near the truth. Secondly, there is the obtaining of an equilateral triangle, by taking up a single link of the chain and extending the other ninety-nine in thirty-threes upon three arrows, which is the best way of clearing an obstacle that intercepts the progress in a line of chainage. Thirdly, there is the method of equidistant ordinates, which, though, like the taking and giving, it requires some judgment, is a great means of simplification. Fourthly, there is the accurate reduction of an ascending or descending line to its horizontal base, which is always best done by trigonometry. Fifthly, there is the allowing for the "spherical excess," which is a matter of great importance in the lines of verification, when a surface survey is of great extent. Such lines, if they are of any considerable length, ought never to be measured by the chain, but deduced by triangulation from an accurately determined base; and, as all triangles on the surface of the earth are spherical triangles, of which the three angles amount to more than two right angles, the excess ought always to be allowed for, if the lines are of any considerable length. Sixthly, there ought to have been some notice of the means of reducing a triangle of double obliquity to the horizontal plain. Besides these there are a few other matters connected with the simple processes of measuring lines and determining areas, which are of more use in important surveys than many are apt to suppose.

The gravamen of the whole matter, upon which, however, not the slightest accusation is meant to be brought against Mr. Bruff, lies in the total omissions involved in the second leading point to which we have alluded; and these apply equally to surveyors of estates, of common roads, and of railroads. In each and all of these cases a surveyor can furnish information which cannot readily be obtained by any other party. In the surveying of land there should be something more than mere measurement; for the accomplished surveyor ought to be able to tell the value of that land as depending upon its geological character, its elevation, and its slope; because these are important elements in the knowledge of its worth, whether it is to be purchased, or be taken on lease for farming purposes. In like manner, a judicious surveyor of a new line of road, or of an old one to be improved, ought to return, along with the survey, an account of all the ups and downs, and varieties of soil, over which it is intended to pass, and of the situation and quality of the materials which are likely to be used in its construction. A railroad surveyor gives, according to the measure of his ability, the ups and downs of the line; but the information which we are not aware of any such surveyor having in any one case given is of far greater importance. He ought to return an accurate account, from the most careful observation, of the nature of the soil through which every cutting is to pass, and of that of which the requisite embankments are to be made. It may be supposed that these matters are the business of the engineer; but the fact is not so. It is, or at all events it ought to be, the business of the surveyor to furnish all the requisite observation as to the kinds of strata through which the line has to be carried; and, besides this, though it is not so especially binding on him, he ought to be able to return an account of the degree of slope at which the banks of every yard of the excavations and the embankments will stand secure in the most trying weather which the line is likely to experience.

These may, in each of the three cases to which we have alluded, appear to be severe labours for the surveyor, and no doubt, as long as surveyors are mere measurers and nothing else, information so valuable could not be expected at their hands. But regarding, as we do, the surveyor one of the most important of the three professions, we think that he ought to be capable of doing these things; that he ought to do them, and be remunerated accordingly, for we are well convinced that half the losses and failures which have occurred in public works have been owing to the employment of incompetent men at small salaries, in this department. How the evil is to be remedied we do not exactly know; but we would say, in the way of experiment, "LET US HAVE AN INSTITUTION OF SURVEYORS."

RAILWAY SUGGESTIONS.

SIR,—It is painful to observe the frequent accidents and loss of life to travellers on railroads, arising, not unfrequently, from neglect or inattention: my object, however, is, not to throw reflections on any party, whether commanding or obeying, but only to hint some suggestions tending to diminish accidents of this description, and which, I trust, will be considered a sufficient apology for the intrusion I make on your valuable journal.

In the first place, I will suppose a double track of rails laid down firm and secure, and to be always kept in that state. Secondly, travelling in opposite directions on one track of rails should never, on any consideration, be allowed. Thirdly, Station places should not be erected in, or immediately on, the entrance of a curved excavation, nor on the commencement of a curve passing a hill, but, if unavoidable, a side road, or branch of rails, should be provided, and no stoppage on the main road, in such places, be permitted. It is almost needless to add that the care of the shifting points on such station places should be entrusted to careful and attentive persons, and no others. It appears to me that such men as have by accident lost a leg or an arm, or are otherwise unfit for general employment, would be the fittest persons for this service; at the same time it would afford such unfortunate sufferers the means of subsistence, inasmuch as the fear of losing their almost charitable employment would have a tendency to keep them attentive, when others have nothing more serious to apprehend from neglect of their duty than a discharge from their employment, which may soon be recovered by an engagement elsewhere, which in the former case is not so easily obtained. Fourthly, each locomotive engine should be provided with a lantern, always lighted in foggy weather or at nights, sufficiently elevated to be seen in all directions over the carriages, from behind as well as in front of them; such lantern might be suspended immediately below the top of the chimney, one in front and another behind; the care of these lanterns would, of course, be with the engine driver, who at his peril would not forget to pay due attention to his signal.

Through one of these oversights not being attended to, a most

destructive collision happened about two years ago, on the opening of the North-Vienna railway, where several lives were lost, and a great number injured. The accident took place from the following circumstances. The trains, three in number, left Vienna in the morning, and arrived in Brunn (about ninety English miles north of Vienna) at noon; in departing from Brunn, another train was added for the accommodation of the governor and chief inhabitants of that city, and an engine, not adapted for fast travelling, was attached to this train. For the sake of compliment to the governor, it was ordered to depart first, and the first station place being situated on the termination of a curve passing a hill, and, consequently, hidden from view, except within a few hundred yards, and five minutes only being allowed between each successive train, the first train, being a slow one, having arrived later than expected, the second came up behind it with barely time for stopping with safety; the third coming at a full speed, a collision, more horrible than can be described, took place: the framing of the last carriage of the second train was literally driven on top of the next one; the other parts of the two carriages were shattered to atoms, and their unfortunate inmates presented the most horrible spectacle that I ever witnessed. I, fortunately, had been detained from the second and third trains, and, consequently, had no alternative but to go in the last, to which delay I owe my escape.

If what I have stated shoud meet with due consideration from parties concerned in the management of railways, I have no doubt but accidents arising from collision would be less frequent, if not totally ceasing.

I am, Sir, your's obediently,
G. V. G——N.

October 23rd, 1840.

[Some of our correspondent's suggestions are certainly worth consideration, especially the running on one line of rails from either way, the practice of which, even if only occasionally resorted to, ought most decidedly to be reprobated. We would be answered with a long list of rules and regulations, starting times and arrivals; but we will say that human life is far too precious for such chances and calculations. We do not mean to infer that this is the case on the railway lines generally, it is only resorted to on account of repairs or other contingencies; but our opinion is, and we think it a pretty general one, that in urgent cases the traffic ought to be stopped for a time; and in others at least delayed, to allow for a concentration of force upon any given point. This certainly is a vital subject, and calls for astringent measures. Our writer's views respecting the poor fellows-the-worse-for-accidents being made useful at the stations is indeed a matter of another stamp, and would serve to fill such places with a motley of almost useless personages, or give them the character of curiosity shops. However, we thank him for the care he has taken in noticing the subjects, and recommend the same to our readers.]

PARISH SURVEYS.

Sir,—Accidentally meeting with the last number of your valuable journal, I was induced to purchase the preceding ones, and on perusing them, my notice was particularly attracted by "*A Surveyor's*" letter, which appeared in No. V. It referred to the parish surveys now taking place under the Tithe Commutation act, and suggested that the non-approval by the commissioners of most of the plans submitted to their examination has been occasioned by the low rate at which the surveys were undertaken, and consequent scanting of the work. Undoubtedly the suggestion is in part correct; but I beg to add that there are other reasons connected with their failure besides the difficulties presented by the "Woody dell," or the lack of competent surveyors. The principal one of these I consider to be the uncertainty of the surveyor as to what is required of him, by those to whom the testing of his work is assigned; as the regulations first issued by the commissioners were six or seven in number, and now amount to thirteen or fourteen. Thus, if the surveyor forwards a plan and reference strictly in conformity with the established rules, the chances are, that it will be returned with two or three fresh regulations affixed. This, and the rigidity of the examination to which plans are subjected (and which will be sufficiently proved by the fact of quantities of 9 or 10 acres having been returned for alteration, where differences of only 2 or 3 perches have occurred, between the surveyor's computation, and that of the examiner), must naturally lead to such a protracted business (if not ultimate rejection of the map) that all confidence is lost between the surveyor and his employers, and not unfrequently ends in bringing a good surveyor into disrepute.

Once let the commissioners establish a set of standing rules, subject neither to addition nor subtraction, by which examinations are to be conducted, and the difficulty of getting plans approved will be abolished. Hoping you will do me the favour to insert this,

I am, sir, your obedient servant,
"An Old Practitioner."

Croydon, Oct. 19th, 1840.

ON THE DUTY PERFORMED BY CORNISH STEAM-ENGINES.

[from the mining journal.]

Sir,—I noticed in your valuable journal of the 19th ult., a statement of the experiments tried on several engines in Cornwall, for the purpose of satisfying the deputation from the Dutch Government of the correctness of the monthly reports of duty stated to be performed by the engines in Cornwall. Of the accuracy of these experiments I have no doubt—having myself tried similar experiments, and knowing that a trial made for a short period may exhibit the extraordinary results stated. I think, however, for practical purposes—for the promotion of which your journal appears to be a most strenuous advocate—the average duty performed for twelve months would be a better criterion of the advantages to be obtained by adopting the Cornish system; at any rate, I trust the following comparative statement of the duty performed by several engines, from September, 1839, to August, 1840, inclusive, and the duty done in short trials, will prove interesting to some of the readers of your journal:—

TABLE.

ENGINES.	Diameter of cylinder.	Duty reported as performed during a six hours trial.	Average duty performed during twelve months.	Aver. coals per hour per horse power.	Greatest duty reported in one month.	Lowest duty reported in one month.	Variation in duty.
	Inches.	lbs. lifted 1ft. high	lbs. lifted 1ft. high	lbs.	lbs. lifted 1ft. high	lbs. lifted 1ft. high	per cent.
Fowey Consols—Austen's	80 single	122,731,766	81,688,669	2·28	85,280,227	76,922,755	10 8-10th
Wheal Vor—Borlase's	80 ,,	122,300,893	79,835,245	2·32	85,035,814	73,844,259	15 1-10th
Wheal Darlington	80 ,,	78,257,675	76,371,172	2·43	84,042,418	70,389,548	19 3-10th
Charlestown United Mines	50 ,,	55,912,393	52,730,907	3·51	56,069,046	45,177,492	24 1-10th
Ditto Stamping Engine	32 ,,	60,535,000	54,575,056	3·40	59,589,084	51,140,412	16 5-10th
Wheal Vor ditto	36 double	50,085,000	53,190,264	3·48	56,274,932	48,125,905	16 9-10th
The Cornish Engine at the East-London Water Works, Old Ford, designed and erected by Mr. W. West	80 single	118,522,475 (6 hours trial, April 24, 1339)	77,319,717	2·40	83,390,587	69,783,079	19 3-10th
A Boulton and Watt Engine, on the same works—boiler, cylinder, &c., clothed with Borradaile and Whiting's Patent Felt, and pumps fitted up with Harvey and West's Patent Valves	60 ,,	——	35,600,055	5·30	——	——	——

As regards the duty stated to be performed by the single engines, in the foregoing table, no comparison, excepting a very vague one, can be made, as the arrangement of the pumping machinery in one may, necessarily, be such as to cause more friction than in another; and thus the engine representing the greatest duty may, in fact, be inferior to that *reported* as doing the least: these remarks refer particularly to the pumping engines. Again, the quality of the coals is a most important matter for consideration. The coals used for the engines in Cornwall are generally Welsh coals—the best that can be obtained—while the coals used for the East London Water-works engines were the refuse of Newcastle coals—after having passed through a sieve, whose meshes were not wider apart than three-fourths of an inch, and, consequently, the chief portion were very small, approximating to dust: the low price, however, renders it the most economical coal for use in London. Again, the friction of the pump-work of the East London is much less than that of any of the engines in Cornwall before quoted, and, with the same quality of coals, would, consequently, show a much greater duty. It must also be borne in mind that, *cæteris paribus*, the duty will be less in an engine of small size than a large one—the friction being directly as the diameters, and the power as the squares of the diameters of the cylinders.

As regards the Boulton and Watt, or low-pressure engine, quoted above, it should be observed that it generally works about one-third expansive—that about 15 per cent. of the duty is due to the introduction of those excellent valves patented by Mr. Nicholas Harvey and Mr. Wm. West; and that 25 per cent. is due to the complete clothing of the boiler and flues, and casing of the steam-jacket, top of cylinder, nozzle, and steam-pipes, with Messrs. Borradaile and Whiting's patent felt—with the ordinary valves, and with the boiler and cylinder, &c. exposed, or not clothed—the duty attained did not exceed 24,138,000 lbs. lifted one foot high, and the engine required 7·68 lbs. of coals per hour per horse power.

An inspection of the table will show how little reliance is to be placed on short trials, for, in the same engine, the variation in duty during twelve months regular work is very great; and taking the Wheal Vor stamping engine, the duty done during the short trial was less than the average *reported* duty for twelve months.

The average number of engines reported by the Messrs. Leans', during the twelve months referred to in this letter, was equal to 54¼th; the coals consumed by them equal to 51,887 tons, and the average duty performed was equal to 54,875,000 lbs. lifted one foot high, while the average duty performed by the best engine was equal to 81,088,669 lbs. lifted one foot high. Now, if all the engines in Cornwall were made upon the same plan as that of the best one, the saving in coals would be very great—making an allowance for the varying diameters of the cylinders, and, for that purpose, assuming the average duty to be only 75,000,000, then, upon the fifty-four engines reported, the saving would be equal to 13,923 tons of coals annually: thus—

Duty. Tons coals. Duty. Tons coals.

75,000,000 : 51,887 :: 54,875,000 : 37,964

51887 — 37964 = 13923.

What the saving upon the whole of the engines in the county might be, I cannot say, as, unfortunately, fifty-four only are reported; and this is much to be regretted, as there is very little doubt that the laudable rivalry excited amongst Cornish engineers by the publication of Messrs. Leans' "Monthly Reporter" has done as much to place the Cornish engines in the position of superiority they now hold as any thing else—and as the value of the system adopted in the working of the best engines in Cornwall is now more generally appreciated than it was a few years back, it behoves the Cornish engineers to continue their exertions as strenuously as, if not more so than, before, that they may continue to keep their high place amongst the steam-engineers of the kingdom.

I am afraid, Sir, I have made this paper too lengthy, but having been engaged for some time past in a series of practical experiments, continued for long periods, which I hope shortly to complete, and finding, by experience, that little reliance can be placed upon trials of short duration, I could not abstain from expressing my opinion upon the trials in question. After all, the average quantity of coals consumed per annum is the question that affects the proprietors pocket, and this should never be lost sight of, whether in Cornwall, London, or Holland. I cannot conclude without acknowledging the great liberality of the Cornish engineers in always readily affording information, and to this I can bear personal testimony.

I am, Sir, your obedient servant,

THOS. WICKSTEED, Civil Eng.

Old Ford, Oct. 5.

REVIEWS.

"CEMETERY INTERMENT.

"CONTAINING A CONCISE HISTORY OF THE MODES OF INTERMENT, ETC.; DESCRIPTIONS OF PERE LA CHAISE, ETC.; THE ENGLISH METROPOLITAN AND PROVINCIAL CEMETERIES, AND MORE PARTICULARLY OF ABNEY PARK CEMETERY, WITH A DESCRIPTIVE CATALOGUE OF ITS PLANTS AND ARBORETUM." BY GEORGE COLLISON. LONDON, 1840.

THOUGH we have somewhat abridged it, the above title will serve to show how multifarious are the contents of this volume: on which account it will probably acquire greater popularity than if it had been more strictly confined to the subject of modern cemeteries, and to the description of the principal ones among them. To say the truth there is too much of *bibliopœia*,—the English term would sound more offensively—to suit our taste, and not a little also that is absolutely dragged in for the nonce, but which we dare say will prove *ad captandum* to many, especially in regard to Abney Park, who will here meet with a full account of the ceremony of the dedication of that cemetery, and the address delivered on that occasion by the Rev. Mr. Archer. Abney Park itself is not without its historic traditions and records: Oliver Cromwell is *said* to have been buried there; and Dr. Isaac Watts is known to have resided there in the hospitable mansion of Sir Thomas Abney, and afterwards of his widow, for the last thirty-six years of his life. Accordingly, several pages are devoted to that eminent man, which is, of course, meant to be complimentary to the doctor's memory, but hardly is it so to the *memories* of the readers to suppose that they have forgotten, or know not where to look for, what is here repeated.

Beyond this remark we shall not touch farther upon matters of the above kind, and shall likewise entirely pass over several others here introduced. The advantages of cemetery-interment itself, as opposed to the practice of burying in churches and within churchyards in towns, are obvious enough; therefore do not require to be enforced by sentmeintal remarks,—which last might very well be dispensed with altogether, because, although it is discreetly kept as much as possible in the back ground, there is something exceedingly prosaic and unsentimental attending our cemeteries, which is, that they are mere trading speculations on the part of joint stock companies. Harm in this there may be none, but it is certainly a most anti-poetical circumstance in itself, consequently, the sentiment becomes rather an impertinence, as incongrous as compliments of condolence tacked to an undertaker's bill. But there is another and far more serious objection attending the cemetery-system itself in this country, and which ought to have been checked at the very first; which is, that religious differences and party spirit are allowed to exhibit themselves with a degree of punctilious hostility that must be considered lamentable, unless it should happen to strike as ludicrous. Wherefore there should be a greater horror "of evil communication" and bad company among the dead than among the living, we leave others to determine; but, as we do not allot different streets and quarters in our towns to different religious sects, we think all distinction of territory might very well be spared in a necropolis, or city of the dead. The establishing a sort of *cordon sanitaire* between the different portions allotted respectively to this or that sect of Christians partakes as much of pharisaical pride as of any more laudable feeling or sound religious motive. But our readers will probably here exclaim, that we, too, are now touching upon what does not immediately concern either them or ourselves.

Dismissing the other contents, we, therefore turn to that portion of the volume which gives accounts of Foreign and English cemeteries. These are not quite so full and circumstantial as they might have been made, nor do they contain much of original description or remark, ex-

cept that of Abney Park. We give, however, upon the authority here furnished the relative dimensions of the following cemeteries, bringing them together tabularly.

	Acres.	Architect of the Chapels, &c.
Mount Auburn, near Boston, America	110	
Kensal Green	46	
South Metropolitan, Norwood	40	Tite.
Highgate .....upwards of..	20	Geary.
West of London, Earl's Court.....	40	Bond.
Abney Park, Stoke Newington.....	30	Hosking.
	176	

The cemetery grounds, therefore, within the vicinity of the metropolis do not at present exceed 180 acres, in round numbers; and, though that quantity may be rather under than above the truth, it seems disproportionately small in comparison with the size of the one at Boston. To the above, however, must now be added another, Southern London Cemetery, lately consecrated, and situated at Nunhead, between Peckham Rye andNew Cross, the extent of which is about 50 acres. Farther than this, we know nothing relative to it, except that Mr. Bunning is the architect there employed.

The buildings at the Norwood Cemetery require no farther notice from us, having been already described and engraved in our number for September. Of the architecture introduced into the other cemeteries we can by no means speak very favourably, far less in such terms as Mr. Collison has done, who, in his account of the West of London one, says that, "the entrance is in the Italian style, and pleasing in appearance;" which is saying very little, or in fact what amounts to nothing; and yet that little is in our opinion incorrect, though conveniently vague and indefinite. If a few Italian Doric columns constitute an Italian style, then that building may be so denominated, but, with such exception, it has scarcely a feature in common either with that or any other style; and so far from being at all pleasing to us, it is, on the contrary, quite disagreeable and unsatisfactory, whether considered as a mere architectural composition, or with reference to its particular purpose, in which last respect it has no distinguishing character nor expression. That such a design should have been adopted is the more to be regretted, because there was a very superior one sent in by Messrs. Kendall and Allom, the model of which, at least of the chapels, was exhibited at the Royal Academy in 1839.

Whether there was any kind of architectural competition in the case of the Abney Park Cemetery we have not heard; but, if there was, either, the choice must have been a bad one, or there was nothing good to select, for Professor Hosking certainly does not shine on this occasion. Mr. Collison, however, devotes more space in his book to that cemetery than to all the others together; and also gives several views of the buildings and grounds. The entrance is pleasing enough, but has more the air of being a mere park entrance than one to a public cemetery, it consisting of no more than four piers, with Egyptian caps to them; connected, by plain bronzed railings, with the lodges or wings, which also partake of the Egyptian style. The whole is simple and handsome, but it would have pleased us still better had the railings been confined to the gates between the piers, and the parts between them and the lodges been a wall of solid masonry, as the composition would have thereby acquired a degree of massiveness consistent with the style, and also of architectural importance, which it now wants. Yet, though we do not object to this entrance in itself, even in its present state, it is so far exceptionable as that it does not at all prepare us for the chapel, the latter being in a style altogether different, namely, the earliest pointed, with lancet windows. Even such want of congruity as to style we could in some measure excuse, were the chapel more satisfactory in itself as a design; whereas it only affords another instance that the forms and individual parts peculiar to a style may be employed with the grossest violations of its idiom.

"The external details of the composition," says Mr. Collison, "were evidently studied upon the earlier part of that truly beautiful example of our ancient works, Beverley Minster;" from which the reader is left to infer, as matter of course, that the Abney Park structure is beautiful also. For our part we are only the more disappointed at finding that any study of Beverley Minster should have led to so exceedingly poor an idea; for, even were the design itself many degrees better than it actually is, the building is upon so small a scale as to look too much like a model or diminutive copy of a larger one. Not only is it small, but it is *little* also, besides partaking of insignificance and meanness, resulting from parsimoniousness without economy. For both economy and good taste would have been far better consulted, had the present tower and spire been omitted, and the saving so effected been applied to properly finishing up the now meagre and scanty features of the rest. It should, however, in fairness be observed that the design as now executed is only a curtailment of the original one, nearly one half of which has been lopped away; notwithstanding which, the directors, it seems, insisted upon the central tower and spire being retained. Whether the architect felt qualmish or sick on the occasion we are not informed; but upon some men, at least upon one whom we know, such direction and directorship would have operated as an emetic, and have caused him to *throw up* the commission altogether.

"A GLOSSARY OF CIVIL ENGINEERING, COMPRISING ITS THEORY AND PRACTICE." BY S. C. BREES. WITH ILLUSTRATED ENGRAVINGS. LONDON, 1840.

This work will be found a great boon to the young hands in the profession, who on their first entrance are, in a great measure, confused and puzzled, and in not a few cases, perhaps, disheartened from the pursuit of the profession, by the technical terms employed, and which render it almost a sealed language to all but the initiated. This want Mr. Brees has, to a great extent, obviated. He has not confined himself to a merely dry detail of description, but has interwoven other particulars which make the explanation no less entertaining than instructive. For instance, the article "bridge," is illustrated with elevations and descriptions of the Menai, the Rialto, Waterloo, London, and Southwark, and Glasgow Bridges, with others too numerous to be particularized, besides entering into particulars of the above in single arches and centerings. Indeed, throughout, the same care and attention displays itself so far that we feel ourselves at a loss to point out one subject more than another treated with greater perspicuity. The work will be found of great use not only to the young beginner but also to the more experienced man. From the nature of the work, and for the reasons we have stated, it will be perceived that which renders it of value to the practical man, in a measure, incapacitates it from being treated in more detail by us by way of extract or otherwise; but we cordially recommend it to the notice of our readers, and have no doubt the author will find the same support which has hitherto attended his perhaps not unpleasant, but certainly unassuming, labours.

"CEMETERY DESIGNS FOR TOMBS AND CENOTAPHS." BY STEPHEN GEARY, ARCHT.

We are glad to see this subject taken up in such a spirited manner. The designs are rich and elaborate, and are capable of being modified to an almost endless variety. We presume, as we notice reference figures to each, that it is intended to have an accompaniment by way of description, which would greatly enhance the value. Indeed, this subject admits of, and we warrant would amply repay, being cultivated to an almost indefinite extent, and made a symbolical view of the character, genius, and even station in life, of those who would wish to be honoured after they have passed from here. We are so well pleased with the labours of Mr. Winkles that we make no apology for transcribing the address;—

"The substitution of the spacious Cemetery for the crowded and gloomy Church Yard is one of the many and important alterations which the improving spirit of the age has effected, for the health and convenience of the English Metropolis; and few years will elapse ere a discerning Public will perceive the propriety of prohibiting the use of small spots of ground, in the very heart of the Metropolis, as sepulchres for the dead. Within the narrow limits of a Parish Church Yard no capability exists for the display of artistical arrangement in those memorials that paternal love, filial piety, and sacred friendship, erect over the graves of departed worth. The chisel of the sculptor is exerted in vain where tombs are crowded together, and the most splendid and characteristic monuments are unproductive of effect when the ground on which they are situated fails in affording to the spectator a commanding view. On the various sites that, in the neighbourhood of the Metropolis, have been prepared for Cemeteries these objections do not exist; and such improvements in Sepulchral Architecture and Decoration may now be expected that, instead of the usual gloom presented by the Church Yard, a romantic and pleasing appearance will be imparted to the last resting-place of the dead. The object of the present work is to furnish a series of Designs for Tombs and Cenotaphs, and will prove of vast utility to architects, to sculptors, to upholders, and others professionally engaged in rendering the last duties to the dead; by means of this work an ample collection and rich variety of Sepulchral Monuments may be submitted to the consideration of the surviving relatives and friends, affording an opportunity of selecting a memorial as taste and circumstances may dictate."

IMPROVEMENTS NECESSARY IN THE RIVER THAMES.

The Navigation Committee are making a stir about the condition of various parts in and about the River Thames, which has, particularly since the removal of old London Bridge, presented many serious obstructions in its beds. There can be no two objects more disgraceful to those who are competent to effect extensive improvements than the bridges of Battersea and Putney. In consequence of the awkward and unscientific manner in which the piers of these crazy old structures have been erected, the tide sets crossways amongst them, so that all sorts of craft pass frequently at considerable hazard, and many lives are annually lost by the upsetting of boats at the juttings of the narrow arches. The Committee are endeavouring to prevail upon the proprietors to widen the arches, and to make such other alterations in the bridges as may correspond with the changes which the river is undergoing, where amendment is more difficult, and the advantages likely to result less palpable. Before Mr. R. S. Jones conceived the project of removing old London Bridge altogether, a very important alteration was made in that fabric by the enlargement of the centre arch, accomplished by throwing two into one, and the judgment of the bold architect who advised the experiment was highly commended. Experiments something similar are, we understand, not only recommended by the Committee to the shareholders of the Battersea and Putney Bridges, but pressed upon them as indispensably required, under existing circumstances. Hitherto advice, recommendations, and expostulations, have been unavailing; but, if the proprietors continue insensible to the present applications, it will be the duty of the Navigation Committee to proceed for the attainment of the great public object, with the assistance of the city solicitor. Indeed, the Navigation Committee are blamed for not having tried the efficacy of indictments in the cases of these two perilous eyesores. In them lies the jurisdiction called the conservancy of the Thames, for the Lord Mayor is merely the nominal head, and the courts of conservancy the formal type and ostentation of their authority. While they are about improvements, it would be as well if they included Hampton Court Bridge in their views. That bridge next to those we have mentioned presents the most dangerous impediments to the navigation between London Bridge and Staines, the limit to their power. Mr. Walker is now engaged in the laborious work of improving Westminster Bridge, and during the operations there the commissioners will not permit the ballast engines to be worked in the vicinity, from the apprehensions entertained of the foundations of some of the piers. The moment the improvements are completed, the most effectual means will be adopted to clear away all the obstructions arising from shoals and other impediments which have so vastly increased in that part of the river since the removal of Old London Bridge with its dangerous cataracts.

PROGRESSIVE INCREASE OF TRAFFIC ON RAILWAYS.

(From Baron Charles Dupin's Report on the Paris and Orleans Railway.)

Experience has proved, both in France and abroad, that in a short space of time the facility, expedition, and economy, afforded by railways, more than doubles the number of passengers and the quantity of merchandise.

In order to support such statements, we will quote the following facts relative to the railways of Belgium, England, and Scotland, in positions of extreme difference, and giving rise to a variation in the returns which far exceeded all anticipation.

COMPARISON OF THE NUMBER OF TRAVELLERS CONVEYED DAILY THROUGHOUT THE WHOLE OR A PORTION OF THE LINE.

Railways.	Before the Establishment.	After the Establishment.
Manchester and Liverpool	400	1,620
Stockton and Darlington	130	630
Newcastle and Carlisle	90	500
Arbroath and Forfar	20	200
Brussels and Antwerp	200	3,000

INCREASE OF THE NUMBER OF PASSENGERS BY THE ESTABLISHMENT OF A RAILWAY.

Liverpool and Manchester	300 per cent.
Stockton and Darlington	380 per cent.
Newcastle and Carlisle	455 per cent.
Arbroath and Forfar	900 per cent.
Brussels and Antwerp	1,400 per cent.

Thus, even taking as a criterion the road on which the proportional increase is least of all, we still find that the number of passengers will increase, not only 100 but 300 per cent. The transport of merchandize will experience a similarly rapid increase. We may judge of this by the progress which has been made in the conveyance of merchandize in French steam vessels, conveyance of much greater expense than by railway.

PROGRESS IN THE CONVEYANCE OF MERCHANDIZE BY RAILWAY COMPARED TO THAT OF PASSENGERS.

Years.	Passengers.	Tons.
1834	924,063	22,909
1836	1,248,552	161,501
1838	1,535,189	264,808

Thus, while the number of passengers has increased 60 per cent. in four years, in the same time the quantity of goods increased 1,100 per cent.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

New Galvanic Telegraph. — The peculiarity of this instrument consists in its requiring only three wires to be stretched between the two stations, by means of which forty-two signals are transmitted, and an alarm given, the method of producing which is also believed to be peculiar. This may be thus explained. The galvanometer by which the alarm is given is distinct from those by which the other signals are produced, and is placed in the circuit of one of the wires. It consists of two coils of copper ribbon attached together and placed parallel to each other, with a space between them. Two needles are suspended within the coils, having a platinum wire terminating in a small spiral coil across the direction of the needle. Under the end of the platinum wire is placed a spirit lamp, with a small flame, by means of which the platinum coil is maintained at a white heat. When the needle deviates by means of the galvanic influence transmitted from the other end of the telegraph, it carries round with it the hot platinum coil, which meets a fine cotton thread stretched in its course. This thread is attached to a cord, by which a pendulum is drawn aside from a bell or gong, upon which it tends to fall. The moment that the hot wire touches the thread it burns it, and the pendulum, being freed, strikes the bell or gong, and thus the attention of the person at the telegraph is called to the signal that is made. To prevent mistakes, the signals are returned at such intervals as may be agreed on, either letter by letter, or word by word, the same wires being used to return as to transmit the signal. The wires are brought into connection with the plate of the battery by dipping the connecting wires attached to the keys into mer-

cury; the galvanic action thus only affects the different needles during the time that any key is kept down.

On Extinguishing Fire in Steam-Vessels.—Mr. Wallace's principle might be explained by the following mode of applying it on board of the *Leven* Steam-boat. On the cabin floor of the steam-boat a space of ten feet by fourteen feet was covered with wet sand, on which were laid iron plates, and on which a fire was kindled of very combustible matter, consisting of old tar barrels, &c. The quantity of this material was about four and a half cwt. A hose thirty-four feet long, two and a-half inches diameter, extended from the boiler of the engine to the cabin, and when the fire had been sufficiently kindled, so that the panes of glass in the windows of the cabin began to break by the heat of the flames, the steam was let in, and the cabin shut. The fire was extinguished in about four minutes. Several trials were made; all of them terminated in extinguishing the fire with the same success.

Mr. Hodgkinson read a paper relative to a series of similar experiments made by him on the strength of iron pillars. It appeared from these that a pillar square at top and bottom was about three times as strong as one rounded at the ends—that if the pillars were not placed perpendicular at least two-thirds of their strength was lost—and that they were one-seventh stronger when swelled in the middle, like the frustrum of a cone with the base in the centre.

Mr. Fairbairn exhibited a model of an engine for raising water, which he had suggested for the purpose of draining the lake of Harlaam, in Holland, which covered upwards of 50,000 acres. It was his opinion that this could be accomplished by the application of a Cornish engine of from 200 to 300 horse power, attached to a scoop 30 feet square, the one end of which was made to move on a centre. In the bottom of this scoop, which was curved, were several valves, opening upwards, on the side nearest the engine. By the descending stroke of the engine, this side was immersed in the water and filled by the valves. The returning stroke, or rather the weights attached to the other end of the beam, raised the scoop, and threw the water into a canal at a higher level than the lake. Such an engine as he proposed would lift 17 tons of water each stroke, and make 7 or 8 strokes a minute. The average depth of the lake was 10 feet. The engine was so constructed as to give the dipping of the scoop a longer or shorter stroke as required.—A member gave a short account of the mode adopted in draining some of the fens in England, which was done by an engine on Watt's principle, turning a kind of bucket-wheel, and raising the water into the adjoining river.

Geology.—Professor Johnston stated the substance of a paper he had given in on the subject of chemical geology. He confined himself to the consideration of the coal formation. He took it for granted, on the part of geologists generally, that coal is derived from vegetable substances, and proceeded to consider the character and action of the agents at work in the process of its formation. He discarded the names employed by some geologists to describe the different characters of coal, such as caking, bituminous, &c.; and, as carbon, hydrogen, and oxygen, are the components of all vegetable matter, he proposed to describe the various characters of coal by a chemical mode of notation, indicating the relative proportions of these qualities in coal. Thus, the Newcastle caking coal, and anthracite Welsh coal, were described as follows:—

	Newcastle Coal.		Welsh Coal.
Carbon	89·19	..	94·05
Hydrogen	5·00	..	33·38
Oxygen	5·81	..	2·57

He went on to show that it is the peculiar province of chemistry to inquire into the means by which coal is produced from vegetable matter. He then described the process of decomposition which takes place under the united influence of water and atmospheric air. Different kinds of coal, he showed, were not derived from different kinds of wood or vegetable matter; but, in reality, all of them steps in the descent from highly organized matter to a state, as in the anthracites, where organic structure altogether disappears. Coal was therefore derived from vegetable matter, in obedience to a great general law. The learned professor referred to the arguments against the opinion that the wood of the coal formations was drifted in water to the places where they were deposited. The evidence on this point, he confessed, inclined him to the belief that the trees had grown on the spot. One argument was this—some of the coal of the Newcastle fields, for instance, was found so pure as to contain not more than one-half per cent. of silt or foreign matter; how, then, could masses of wood be transported to their present beds without a very great mixture of clay and sand? Another argument was, that over a large area the coal was only one inch thick. In other cases there were different kinds of coal overlying one another in alternate layers, but so different in quality that the miners could dispose of the whole of one seam as fast as they could work it, whereas the next seam might not be worth disposing of at all. In other cases there was observable a regular stratification. All these arguments were urged by intelligent miners against the theory which assigned the coal formation to drifted trees. Without giving any positive opinion on this point of the subject, he would merely say that, on a weighing of the evidence on both sides, he thought the balance was in favour of the idea that the vegetable matter grew upon the spot.

Smoke Protector.—Mr. Wallace exhibited and explained his apparatus for enabling persons to enter places on fire without danger from smoke, by means of breathing through water. A box of tin containing the water is placed on the man's back with tubes connected, forming a ring round the body and straps for the shoulder. A hood of Macintosh cloth glazed in front is put on the head, and being attached to the side tubes, four gallons of water will enable a person to bear the densest smoke for twenty minutes. Several members expressed their high opinion of the protector, and explained its analogy to some other plans in present use in London and elsewhere.

Mr. Smith, of Deanston, exhibited a model of a new plan of canal lockage, the advantages of which he stated to be that the descent in each lock would not be more than 12 to 18 inches—that the locks would open by the passage of the vessels—that the locks shut of themselves—that the vessels did not require to stop—and that little or no water was lost. The lock gate is hinged at the bottom, the upper portion, which is round, floats at the level of the higher part of the water, and is pressed down by the bow of the vessel in passing, and when it is passed rises to its former position. A long conversation took place on the subject, during which the highest opinion was given of the value of the invention to canal navigation. Mr. Smith said that a trial was to be made on the great canal.

On the Economy of Railways in respect of Gradients.—Mr. Vignoles stated that this was a subject selected from a general work on the principles and economy of railways, which he was preparing for publication. Looking to the great cost of railways, he had turned his attention to a comparison of the result of the working of railways, with the price paid for various degrees of perfection. He disclaimed asserting that sharp curves or steep gradients were preferable to straight and level lines, but he would endeavour to show that good practicable lines of the former description might be and had been constructed, on which trains sufficient for the traffic and public accommodation could and did move at the same, or nearly the same, velocities, and with little, if any, additional expense. On an average, the hitherto ascertained cost of the principal lines might be divided thus:—

Land	10	per cent.
Stations and carrying establishment	20	,,
Management	10	,,
Iron	10	,,
Works of construction proper	50	,,
	100	per cent.

though, of course, these items differed considerably in various railways, but in general it might be said that the works of construction constituted one-half of the whole first cost. He left out, on the present occasion, all consideration of the saving of any of the items, except as to the works of construction; though it would not be difficult to show a reduction on these, to the extent of at least one half. Mr. Vignoles stated that he had analyzed the expenses of working railways, and had reduced them to a mileage,—that is, the average expense per mile, per train, as deduced from several years' experience, and observations of various railways under different circumstances, and with greatly different gradients, some of which lines were enumerated. The result on passenger and light traffic lines was, that the total deductions for expenditure from gross receipts was 3*s.* per mile per train; 2*s.* 6*d.* being the least, and 3*s.* 4*d.* the highest; and that this average seemed to hold good, *irrespective of gradients or curves*. Particular lines might, from local circumstances, differ in detail, but he was satisfied that the following abstract was a fair average approximation:—

	s.	*d.*
Daily cost of locomotive power and repairs	1	6
Annual depreciation, sinking funds, and interest on stock, tools, shops, and establishment	0	6
Daily and annual cost in carriage department	0	4
Government duty, office expenses, police, clerks, guards, management, and maintenance of railways	0	8
	3	0

It was not found practicable to distinguish the additional expense, if any, arising from curves or gradients; but as three-fourths of railway expenses were quite independent of these curves, such addition must be small, especially as, on the North Union Railway, a line which had five miles out of 22 in the gradients of 1 in 100, or nearly 53 feet per mile, the total expenses were less than on the Grand Junction Railway, and several other lines. Mr. Vignoles then proceeded to illustrate, by dia-

grams, the mode in which the economy might be made in the works of construction, on what he called the *first system*, by the occasional introduction of inclines of 50 and even 60 feet per mile, if not of too great a length; and again on the *second system* by introducing entire series of severe gradients, such as those of 30, 35, and 40 feet. On the first system he had executed the North Union Railway, and had also thus designed all the government railways for the south and west of Ireland. On the second system was the Bolton and Manchester Railway, by the late Mr. Nimmo, Mr. Macneil's government railway lines for the north districts of Ireland; and that engineer had lately altered the Dublin and Kilkenny and the Dublin and Drogheda railways, from better but more expensive gradients to those on the second system; and Mr. Vignoles had recommended such for an extension of the Dublin and Kingstown railway. He had also laid out the whole extent of the Sheffield and Manchester railway for 40 miles, on an average gradient of nearly 40 feet per mile, mixed with occasional inclinations of 1 in 100, and with curves of one-third mile radius. That work was now under execution by Mr. Locke, who had succeeded Mr. Vignoles as engineer, and who fully concurred in the general principles,—which, asalso the details, and the introduction of timber viaducts on a large scale for economy, Mr. Nicholas Wood approved. Mr. Giles had also adopted the same system on the first ten miles eastward on the Newcastle and Carlisle railway. Mr. Vignoles went on to state that on either one or both of these systems, introduced as might be considered most advantageous by the directing engineer, lines of railway might and ought to be laid out so as not to exceed £10,000 per mile, being particularly applicable where fertile, populous, and manufacturing districts, or the metropolis, had to be connected through difficult and unproductive districts, with the extremes of the empire. Mr. Vignoles concluded by remarking that when a continued stream of heavy traffic justified the expense he saw no reason to vary from the general rules adopted hitherto by engineers for laying out railways, or from his own former opinions and practice. But it was forced on him by daily experience that, to accommodate the public convenience, the post office arrangements, and business in general, it was scarcely once in twenty times that a locomotive engine went out with more than half its load, and in general the engines were only worked up to two-fifths of their full power: he was, therefore, conclusively of opinion that it was much cheaper to put on additional engines on extraordinary occasions; and on such principles railways should be constructed through the more remote parts of the country, so as to be made in the cheapest possible manner. The possession of all the *profitable* lines of railway by private companies was likely to throw on the Government the *onus* of constructing their lines through such districts, in which case economy was desirable; or, if not to be constructed by the government, then was economy still more important; for Scotland, Ireland, Wales, and western and eastern England, would want railways, until some such system as those now promulgated could be brought to, bear in the laying out lines of internal communication.

Mr. Vignoles being asked whether, in the gradients of 1 in 100, on the North Union line, any practical danger was to be apprehended, stated that no danger whatever was apprehended; and that, on these gradients of 1 in 100, the trains travelled *down* at full speed or about 40 miles per hour.

INSTITUTION OF CIVIL ENGINEERS.

Continued from page 213.

March 31, 1840.—"On reclaiming Land from the Sea, with Plans illustrative of Works in Loughs Swilly and Foyle." By J. W. Bazalgette, Grad. Inst. C. E.

The art of reclaiming land from the sea has been practised from a very remote period. Among the instances best known to us are Romney Marsh, in Kent; the Foss Dyke, in Lincolnshire; and the coasts of Holland and Flanders. The extreme fertility consequent on such reclamations has caused many attempts to be made, and nearly all have been successful; but none presents a greater prospect of success than that about to be undertaken under the direction of Mr. Macneil on the borders of Loughs Swilly and Foyle, in the counties of Donegal and Derry.

Lough Foyle communicates with the Irish channel by a narrow inlet, above which it spreads over a wide tract of land, and then, suddenly contracting, joins the river Foyle about four and a half miles below Londonderry, up to which city it is navigable for vessels of 500 or 600 tons burden. The rush of the tide through such a small inlet has carried with it great quantities of alluvial soil, which it has gradually deposited on the side of the lough, and thus formed a bank which extends four or five miles in length, and is only covered by the tide at high water. In order to reclaim this tract of valuable land, of about 25,000 acres, it is proposed to construct, somewhat below low water, an embankment or sea wall of about fourteen miles in length. The tide never rises here above twelve feet, nor is there ever any swell in the lough to endanger the structure.

Lough Swilly is wider at the mouth, which opens into the Western Ocean, and is consequently more subject to the effect of wind, than Lough Foyle. The highest tides rise about 18 feet. Several embankments are proposed, which will reclaim altogether about 2000 acres of land; a tract already reclaimed, which is considered to be of the best quality in the country, lets at £5 per acre. The measurements and soundings to ascertain the best position and requisite depths of the embankments were thus taken. A tide gauge was permanently fixed, on which the range of high and low water was marked: a constant registry was kept of the soundings, and the time at which they were made; these were afterwards reduced to the high or low water of any one tide. The distances were determined at the same time by means of a pocket sextant from the boat, angles being taken between certain fixed objects on the shore, so that the exact situation of the soundings could be ascertained and laid down with great accuracy. The slopes of the faces of the embankments vary on the sea face from three or four to one, and two to one on the land side. Each has a culvert 4 feet diameter, with sluices and flood-gates, founded upon piling with tie beams, and the spaces filled with concrete, the whole being covered with planking. The gates are at the lowest level of spring tides, so as to allow of the greatest degree of drainage. The wing walls of squared rubble-stone stretching on either side of the gates are founded also on a bed of concrete, 4 feet wide by 2 feet deep. These gates are to be used either to keep back the fresh water for the purposes of irrigation, or for scouring away the silt which would accumulate externally in front of them. A bed of puddle, 4 feet 6 inches wide at the bottom and 3 feet wide on the top, extends longitudinally throughout the embankments. The land water is carried away by a series of catchwater drains, which extend around the reclaimed lands at the level of high water, having sufficient fall to secure its drainage through the sluices. These drains are puddled, and have their internal faces covered with sods, at an inclination of two to one.

As there are many situations where stone is very scarce, and where timber abounds, the author has turned his attenion to devising a plan of embanking applicable to such localities. It may be thus briefly described. The body of the embankment should be of clay, earth, gravel, and stones, dug from the surface and thrown up in a bank, with a slope suited to the force likely to act upon it. On the water side is placed a strong facing of fascines, 6 feet thick at the bottom and 4 feet thick at the top, embedded in the soil in an oblique direction, the dip being towards the land; they are securely fastened down by iron screws running at right angles through the whole height. The land face is covered with sods. In a country where wood abounds this kind of embankment would be formed at a very cheap rate. In other situations, where the embankments would be subjected to greater strain, the thickness of the mass of fascines should be increased to 13 feet at the bottom and 4 feet at the top. In this case, at 4 feet from the front of the bottom of the slope should be placed a row of fender fascines, 3 feet wide by 2 feet high, bolted down, for the purpose not only of defending the face of the bank from the action of the sea, but for retaining all deposits left behind by it; by which means the embankment would in time acquire a natural face of soil, as is the case with some of the embankments in Holland. The average cost of this kind of embankment, including the sluices and the necessary bed of puddle in the centre, would be about £12 per running yard.

"On the Use of Mica, as a Substitute for Glass, in the Windows of Workshops." By Joseph Glynn, F. R. S., M. Inst. C. E., &c.

In the windows of the workshops at the Butterly Iron Works so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass. Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less so as to be objectionable; but this circumstance is not important at Butterly, as, in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and, if an extensive use of it could be induced, a more ready supply would be obtained—probably from Pennsylvania or from Russia, where it is commonly used for windows in farm-houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in

masses of nearly 3 feet diameter. It is susceptible of very minute subdivision, as, according to Hauy, it may be divided into plates no thicker than one three-hundred-thousandth part of an inch.

"On a Specimen of White Cedar from Bathurst, New Brunswick," sent by Mr. Churchill.— The specimen exhibited to the meeting was of the dimensions calculated for a railway sleeper, for which use it was proposed to introduce this timber, as it is stated to possess, in a very superior degree, the quality of durability in situations calculated to try its properties. It can be imported at about 3*s.* 9*d.* to 4*s.* per sleeper.

Mr. Hawkins observed that he knew that species of timber well, having seen it extensively employed in the United States. It is an evergreen tree, and grows only in wet or boggy grounds, and is found most plentifully in New Jersey, Maryland, and Virginia. It attains the height of 70 to 80 feet, but is rarely more than 3 feet in diameter. The concentric circles in it are always perfectly distinct, and prove that the tree only arrives at its full growth after a long term of years— as many as 277 annular rings have been counted in a trunk 21 inches diameter, at 5 feet from the ground. The wood is light, soft, fine grained, and easily wrought. It has an aromatic odour, which it preserves as long as it is guarded from humidity. It resists alternations of dryness and moisture better than any other wood; and on this account is extensively used for shingles for roofing. They sell at Baltimore for 4 to 5 dollars per 1000. These shingles will last from 30 to 40 years. It is in great demand for household utensils, so much so, that a distinct class of coopers are called cedar coopers. It is used for boat building on account of its great buoyancy. Cedar boards are sold at Philadelphia at 20 dollars per 1000 feet. White cedar rails, with red cedar posts, form the most durable kind of fence, being known to have lasted from 50 to 60 years. The rails are sold at 6 to 8 dollars per 100, and the posts at 12 or 15 cents each.

Mr. Brunel did not think it was a cheap or a strong wood. He had used it chiefly for covering locomotive boilers, as it resisted heat better than any other wood. Mr. Joseph Horne objected to its use for sleepers on account of its tendency to split so easily; but he had found it resist wet perfectly.

April 7, 1840.—"Account of a series of Experiments on Locomotive Engines, more particularly on the 'England,' the 'Columbia,' and the 'Atlantic,' manufactured by Mr. Norris, of Philadelphia." By Captain Moorsoom, R. E., Assoc. Inst. C. E.

The engines of which the author more especially treats were constructed by Mr. Norris, of Philadelphia, and sent by him to England, under an agreement to supply "locomotive engines of a higher power, greater durability, and less weight," than could be obtained in this country. They were to be subjected to fifteen trials within thirty days, and prove their capability of drawing, "up a grade of 1 in 330, a load of 100 tons gross weight at the speed of 20 miles per hour; and, up a gradient of 1 in 180, a load of 100 tons gross weight at the speed of 14 miles per hour." The pressure of the steam in the boiler was stipulated by the Grand Junction Company (on whose railway the trials were made) not to exceed 60lbs. per square inch. The construction of these engines is very simple, and the work plain. The boiler is horizontal, and contains 78 copper tubes, 2 inches diameter and 8 feet long each, with an iron fire box. The cylinders, 10½ inches diameter, are slightly inclined downwards, and so placed that the piston rods work outside the wheels, thus avoiding the necessity of cranked axles. The frame is supported by 6 wheels: the two driving wheels, of 4 feet diameter, are placed close before the fire box; the other four wheels, of 30 inches diameter, are attached to a truck, which carries the front end of the boiler, and is connected with the frame by a centre pin, on which it turns freely, allowing the truck to accommodate itself to the exterior rail of the curve, and with the assistance of the cone of the wheels to pass round with very little stress upon the rails.

	Tons.	Cwts.
The weight of the engine, with the boiler and fire box full, was	9	11¼
That of the tender, with 21 cwts. of coke and 520 gallons of water, was	6	4¼
Total weight.....	15	15½

The engine, when empty, weighed 8 tons.

The trials were made on the Grand Junction Railway in April and May, 1839, and were continued over the whole distance from Birmingham to Liverpool, except when stopping short at Warrington to take loads; and occasionally making double trips, so as to travel the total distance of 156 miles per day. Attention was more particularly paid to the speed when ascending the gradients, which rise at the rate of 1 in 330 (16 feet in a mile) or 1 in 177 (29 feet 4 inches per mile), and as the engines approached these gradients frequently either at an accelerated or a diminished speed, the observations were made at the points most remote from the cause of variation from uniform velocity. Some of the trials were made with such a number of empty waggons to make up the weight that the train attained a length of nearly an eighth of a mile; this required some allowance, which was estimated at from one-eighth to one-ninth in addition to the actual weight of the empty waggons. The extreme limit of working pressure of the steam in the boiler was 62 lbs. per square inch, except for a few minutes on one occasion, when it rose to 64 lbs. The usual pressure for the locomotive engine boilers on railways now generally at work is from 50 to 75 lbs. per square inch. An analysis of the tabulated results of the several trips give these general results:— That on a plane of 1 in 330, with a load varying from 100 to 120 tons, the speed varied from $13\frac{5}{10}$ miles to 22½ miles per hour; that on a plane of 1 in 177, with a load of 100 tons, the speed varied from $9\frac{8}{10}$ miles to $13\frac{5}{10}$ miles per hour. From the analysis it appears that, allowing in five of the trials the stipulated amount of performance to have been made, and that in five other trials a doubt may exist, still in the remaining eleven trials the exact amount of duty demanded was *not* performed. A comparison of the journeys *up* from Liverpool to Birmingham, with those *down* from Birmingham to Liverpool, gives rather a singular result. The aggregate rise of the gradients from Liverpool to Birmingham is about 620 feet, that from Birmingham to Liverpool is about 380 feet (exclusive in both cases of the Liverpool and Manchester Railway); the difference, therefore, up to Birmingham is about 240 feet. In 7 journeys of 596 miles *up* to Birmingham, the engine conveyed 682 tons gross, evaporated 12,705 gallons of water, and consumed 177 sacks of coke (1½ cwt. each). In 7 journeys of 596 miles *down* from Birmingham, the same engine conveyed 629 tons gross, evaporated 12,379 gallons of water, and consumed 177 sacks of coke. It would thus appear that the consumption of fuel was the same in both cases, and the only difference was the evaporation of 326 gallons of water more in the journey *up* than in the journey *down*, conveying nearly the same load both ways. The author remarks that, in the early stage of his observation on the engine, he would have inferred that, from the mode of construction, it was not calculated for high speeds, such as are required for the mail trains; yet that he has often seen it travel with apparent ease at the speed of 30 miles per hour; and he thinks that, with some slight modification of the working parts, engines of this construction may be made to do any duty now required from locomotive engines; and, from the small quantity of repair required during the trials (only renewing the fire-bars, which were originally intended for burning wood, and putting nine stronger ferules in the tubes), he is of opinion that the present construction is exceedingly well calculated for heavy loads— that it may be modified for attaining high speeds—and will prove a durable and economical machine.

Captain Moorsom stated that, although the American locomotive engines have not strictly complied with the stipulated conditions, yet he considered them good, serviceable engines, and it was the intention of the directors of the Birmingham and Gloucester Railway Company to have ten of them on their line. The price of the engine complete, including the import duty of 20 per cent., is from £1500 to £1600. One of the greatest advantages of the engines is the facility afforded by the truck for going round curves—the same engineers managing indiscriminately the ordinary 6-wheeled engines, and the American ones are observed to go faster round the curves with the latter than with the former. Round a curve of 10 chains radius, they had gone at a speed of 20 miles per hour. They run also quite as well on a straight road. He had travelled on them between Whitmore and Crewe at the speed of from 30 to 40 miles per hour. They appeared less likely to be thrown off the rails than other engines, as in some instances they had run over the short pointers of the Grand Junction Railway—the engineer had merely felt a slight jar, but no accident had occurred. He attributed this to the truck adapting itself so readily to the rails. The coke used in the trials was the same as that in daily use on the Grand Junction Railway, and was of average quality. The mode of attaching the tender to the engine was peculiar, and he conceived it to be advantageous, as it threw a portion of the weight upon the engine and was an assistance in starting. The engines, as they are now constructed, will do well for all ordinary speeds; but, if higher speeds are required, a greater expense must be incurred, and certain alterations must be made in them.

Mr. Sopwith exhibited a model of a tract of 36 square miles of Gloucestershire, comprising the mining districts in the Forest of Dean. This model showed all the undulations of the surface, the towns, villages, and detached buildings, railways, coal and iron mines; and, separating vertically through the centre from north to south, and from east to west, exhibited the geological formation down through the coal measures to the old red sand-stone: the construction is such that, by lifting off horizontal layers, the extent and position of each bed of coal is shown, with the extent of the workings in the different collieries, and on each bed is marked the portion that can be worked by level and freed from water by natural drainage. This coal tract forms an elliptical basin; the longest diameter of which, from N.N.E. to S.S.W. is about 10 miles, and the shorter about 6 miles, ranging round Coleford as a

centre. There are about 20 beds of coal of various thickness, containing together nearly 37 feet of clear coal. The carboniferous strata crop out regularly all round against the mountain lime-stone and old red sand-stone, and dip uniformly towards the centre of the basin. This could scarcely be shown clearly, even by an almost indefinite number of plans, which induced Mr. Sopwith to project the model, the method of constructing which he described to be by forming together in squares a given number of thin strips of wood, joining them by half lappings at the intersections; on these strips the profiles of the sections were drawn, from measurements and borings. The compartments of these skeleton frames were then filled in with lime-tree wood, as being lightest and easiest to work, and carved out to the depth of the lines drawn on the strips; by these means a series of horizontal sections fitting into each other were obtained, and when painted of the proper colours, both on the surfaces and on the edges, produced the complete model which he exhibited. The cost of it was about £30 complete. It was constructed under Mr. Sopwith's direction, and from surveys made by him for the Government.

RECORD OF PUBLIC WORKS.

Preston and Wyre Railway. — The passenger traffic on this line has greatly exceeded the expectation of those connected with it. When this undertaking was first projected, it was estimated that the number of passengers, including 20,000 by steamers to and from Ireland and Scotland, would be 37,043 per annum, leaving only 17,043 for the local trade; but since the opening of the line on the 16th July last, owing to the increased facilities of communication and moderate fares, upwards of 48,000 individuals have availed themselves of this route. It is expected, in the course of next spring, that steamers will ply regularly between Fleetwood and the Isle of Man, Belfast, and Glasgow.

Stockport Viaduct. — On the 13th ult. the twenty-sixth and last arch of that stupendous piece of architecture, the viaduct of the Manchester and Birmingham Railway, at Stockport, was completed. Upwards of twenty splendid banners were arranged along the top of the viaduct, where they remained floating in the air the remainder of the day. In commemoration of the last arch, 140 of the workmen sat down to an excellent dinner, at the Club House, Heaton Norris, where the festivities were kept up till a late hour in the evening.

Manchester and Leeds Railway. — On Monday, the 12th ult., this great and important line of railway was opened, for the conveyance of passengers, from Leeds to Hebden Bridge — thus completing, with the exception of nine miles, the entire distance between Leeds and Manchester. Of this distance ten miles, from Leeds to Normanton, are upon the line of the North Midland Railway; twenty-seven miles, from Normanton to Hebden Bridge, have been now for the first time opened; and thirteen miles from Manchester to Littleborough, were opened in July of last year. The nine miles yet unfinished are between Hebden Bridge and Littleborough, and include the Summit tunnel and the Charlestown tunnel, in the latter of which the works have been so long at a stand, owing to the slipping of the earth. It is confidently anticipated that this distance of nine miles, the final link in the chain, will be ready for opening in the first week in December, when the trains will pass uninterruptedly from Leeds to Manchester. On this line there are no objectionable curves, and there is not one gradient having half the inclination of those on the Liverpool and Manchester Railway. The line is somewhat circuitous, and this is its only disadvantage, — a disadvantage which the speed of locomotive travelling reduces to insignificance. Within three miles on either side of it there is a population of no less than a million. With Manchester and Leeds as its termini, it has Rochdale, Todmorden, Hebden Bridge, Sowerby Bridge, Elland, Bridghouse, Rastrick, Mirfield, Dewsbury, Ossett, Orbury, and Wakefield on its course; and it is situated near, and will ultimately have branches to, the towns of Oldham, Heywood, Halifax, and Huddersfield. The cotton and woollen manufactures are carried on prosperously through the entire district; this forms the line by which the manufactures of Yorkshire are sent to Liverpool for export, and by which the manufactures of Lancashire are sent to Hull for export; and a large trade in corn exists on the Calder, and the canals connected with it. Thus the Manchester and Leeds Railway will be a most important auxiliary to commerce and manufactures, and will give the greatest facilities for travelling to an immense population.

Edinburgh and Glasgow Railway. — The great viaduct across the river Almond and adjoining valley, which is to consist of 36 arches of 50 feet span, averaging about 70 feet in height, when taken in connection with the viaduct of seven arches, across the Bathgate road, (between which and the great viaduct there is only a short embankment,) will form one of the most magnificent ranges of stone masonry in the kingdom — about three thousand feet in length. These works have been designed and carried into execution under the direction of Mr. Miller, of Messrs. Grainger and Miller, the company's engineers. The pillars are far advanced, the fifteenth arch is in progress, and the parapet over twelve of them finished; and the contractors anticipate being able to complete this great viaduct within eighteen months from the time they commenced with it; certainly a period unparalleled in bridge building.

London and Brighton Railway. — This railway is to be partially opened on an early day in the ensuing month, which will enable the communication to be made in four hours from London to Brighton. — October 20.

Great Western Railway. — This railway will be opened to Wootton Bassett before the end of the present year, and the whole line, from London to Bristol, by the 1st June, 1841.

Birmingham and Gloucester Railway. — This railway, it is confidently expected, will be opened to the latter city very early in November. The works along the unopened portions of the line are in a state of great forwardness, and will certainly be completed before the expiration of the present month. When the distance between Cheltenham and Gloucester has been opened, there will only then remain the eight miles at the Birmingham end to be finished, in order to the entire completion of the undertaking. The improvements at the Lansdowne station are proceeding with great vigour. — October 20.

Scarbro', Malton, and York Railway. — This great public undertaking, which has been several years before the public, will shortly be commenced, and carried forward with that energy and spirit which are necessay to insure its success. At York the line will be connected with the west and south by the York and North Midland, the North Midland, the Leeds and Selby, the Derby and Birmingham, the Leeds and Manchester, and the Manchester and Liverpool, the Midland Counties', and the London and Birmingham Railways; with the east, by the Hull and Selby; and with the north by the Great North of England Railway, which will be opened as far as Darlington next month. By a junction with the Whitby and Pickering Railway, it will connect itself with an extensive commercial, shipping, and agricultural district, and by so doing will, no doubt, materially increase its own prosperity, whilst it will enlarge the traffic at present conveyed on that line. The distance of the proposed railway from York to Scarbro' will be 38 miles, being nearly three miles shorter than the turnpike road.

Taff-Vale Railway. — The public opening of the completed portion of this interesting and valuable line, between Cardiff and Navigation House, took place on Thursday week, and was celebrated by the inhabitants of Cardiff, Newbridge, and other places in its neighbourhood, in a manner which showed that they were fully alive to the local and commercial importance of the undertaking. *Oct.* 17.

Railways in the United States. — The Journal of the Franklin Institute contains a detailed account of the railroads in a number of the States, with the length, costs, &c., from the tables of which the *National Gazette* gives the following:—In Pensylvania, the number of railroads is 36, the number of miles opened 576¼, the total length of road 850¼, and the amount already expended 15,640,450 dols. In Virginia, the Carolinas, Georgia, and Florida, there are 23 roads and 994 miles opened; total length, 1,675¼ miles. Amount expended, 18,442,000 dols. In Alabama, Louisiani, Mississippi, Tennessee, and Kentucky, there are 27 roads, 195 miles in operation: total length of roads, 1,148¼ miles. Already expended 9,621,000 dols. In Ohio, Indiani, Michigan, and Illinois, there are 29 roads, 196 miles in operation; total length of roads, 2,821 miles. Amount expended, 5,523,640 dols.

MISCELLANEOUS.

India Coal. — Dr. Hutchison, of the Madras Artillery, has drawn up a report on the coal-fields recently discovered in the vicinity of Mergui, by which it appears that this coal is easy of access, lying at no great depth beneath the surface, so that shafts may be sunk without difficulty. For its conveyance there seems to be every facility, the river being adjacent, and a land carriage of one mile only being required. It is not stated whether the quality of the coal has been tested by experiment, but we presume it to be the same of which Dr. Heifer spoke so highly in his communications. Steamers will begin to ply between the different ports in the bay of Bengal; and the immediate coal depôts between the Presidencies and Suez will be more plentifully supplied, and at a cheaper rate. The effect these circumstances will produce on the destinies of India can scarcely be estimated. — *East India Magazine.*

Fleetwood-on-Wyre. — Three years ago there were only two houses at Fleetwood, and the site of the town was a barren waste overrun with rabbits; now there are 103 houses, inhabited to overflowing, and 54 in course of erection. It is said that a considerable quantity of land is purchased for building upon, but there is considerable difficulty in procuring a sufficient supply of brick, stone, and lime, consequently, building operations are considerably retarded. We may mention, however, that a small but neat church, capable of accommodating about

400 persons, is reared, and that the two shore lighthouses, which will be lighted with gas, are in a forward state, one being about 60 feet high, and the other about 12. As the designs are chaste and beautiful, they will be highly attractive objects to strangers visiting the district.

Locomotive.—Mr. E. Rudge, of Tewkesbury, tanner, has obtained a patent for a new method or methods of obtaining motive power for locomotive and other purposes, and of applying the same. These improvements are for the construction and application of a new form of atmospheric engine, which may consist of two, three, or more open-topped cylinders, placed either vertically or horizontally, the piston rods of which are connected with two or three throw-cranks. The air below each piston in the cylinder is condensed by a jet of steam, when the preponderating influence of the atmosphere on the external surface of the several pistons produces the available power. The cylinders are lubricated by means of a small funnel on the top of the piston rod, whence the oil flows into a hollow space within the rod, and thence into a groove turned in the piston. In order to gain a reserve of power for any particular purpose, a large cylindrical receiver is filled by a condensing air-pump placed on either side, and connected with the main shaft of the engine; thus, when the carriage is descending a hill, the air pumps will compress the air into the large cylinders, which again will supply the air for working the pistons while ascending a hill.

Candian Coal Mines.—The French papers notice the recent discovery of two coal mines in Candia, one upon the north coast, about four hours' journey from Retimo, the other upon the south coast at Preveli, near Sphakia, a short distance from the sea. In May, 1839, it is said 50 quintals of coal were raised from the first-named mine by order of the governor, Mustapha Pasha, and sent to Egypt. A new survey having been demanded, 1,363 quintals were raised in six days, and forwarded to Retimo. The cost of carriage was estimated at 2l. 75c. the 100 killogrammes. In February, 1840, the coal, the produce of the two mines, was essayed in one of the steamers belonging to the French squadron in the Levant. The sample from the mine at Retimo was chiefly in a pyrite, and that from Preveli in a ligneous state.

The Copper Trade.—An account of the copper trade of Great Britain, for the year ending the 30th June, 1840, showing in what way the copper in the ores raised and imported has been disposed of:—

Bought by	Tons	cwt.	qrs.	lbs.
Messrs. Williams, Foster, and Co.	6542	11	3	27
Vivian and Sons	4586	5	1	1
Grenfell and Sons	2444	10	3	10
Sims, Willyams, Nevil, and Co...	2436	18	0	27
Freeman and Co.....	1691	19	1	16
The Mines Royal Co.	1234	9	3	1
Vigurs and Co.....	966	16	0	15
The English Copper Co.....	814	12	2	13
British and Foreign Copper Co.	695	0	0	0
John Bibby and Sons	495	6	2	21
Smelted by the Proprietor of the Mona mine	549	8	3	24
Ditto do. Mixor mine—say.. ...	100	0	0	0
Total..	22,557	19	3	15

Rotary Engine.—An engine upon this principle was tried last Wednesday in Leeds, in the presence of several engineers. Its enormous power, in so small a compass, (the whole machinery, with the exception of the fly wheel, being contained in a box 2¼ inches in depth and 10 inches diameter) surprised every one present; the speed was tremendous, making from 600 to 700 revolutions per minute. Its power was tested by placing breaks upon the fly-wheel, which was done to the extent that the shaft was actually twisted in two pieces, but no accident occurred. It is the intention of the inventor to apply the machine to propel carriages on common roads, for which purpose it appears admirably adapted; likewise for the purposes of marine navigation, where the small quantity of room it requires is a material consideration; in short, it will answer all the purposes wherein steam is required; and the expense will be considerably abridged. The inventor is Josh. Briggs, watchmaker, of this town.—*Leeds Intelligencer.*

The Propeller Steam Boat.—This vessel was built by Mr. Dichburn, of Blackwall. The engine by which her paddles, or propellers, are worked, was made by Mr. Beale, the engineer, at his premises at Greenwich. She is a small vessel, but very elegant in her proportions, and formed to cut through the water with great rapidity. The engine is of 24-horse power. The propellers differ from the paddle wheels in being single blades of iron, only one blade on each side of the vessel, and not a series of blades brought into the water by the revolution of wheels. Each blade is very broad and large, and dips almost perpendicularly into the water, so that the concussion formed by the paddle-wheels dipping at angles into the water is avoided, and the consequent unpleasant vibration of the vessel. Directly the blade dips into the water it is forced back by an arm or limb of iron, performing a motion similar to the leg and web-foot of an aquatic bird, and by means of this motion the vessel is propelled forward. She can perform 10 or 11 knots an hour. The appearance of the propellers is like that of the legs of a grasshopper, and when in motion their action, in some degree, resembles the legs of that insect. One great advantage is that the propellers occasion no swell in the water, no wake or trough in the river, and no backwater, so that no danger is occasioned to small boats by the rapidity of her progress. The vessel runs between Blackwall and Greenwich.

The Mansion-House.—The figures above the pillars of the Mansion-House, which have been for many years completely hidden under a mass of soot and dirt, are now objects of striking interest. As they are in a manner new, even to the residents in the neighbourhood, we shall briefly describe them. The centre is occupied by a female figure, supposed to represent the presiding patroness or genius of the city of London. She holds in her right hand a spear; her left hand is rested on a shield, sculptured with the city arms. She supports a small sculptured castellated tower on her head, and is trampling on a recumbent figure representing her vanquished enemies. On her right hand stands the Roman lictor, and a boy holding the cap of liberty. The extreme right hand angle of the tympanum is occupied by a representation of the superiority of the British Empire on the seas by a large reclining figure of Neptune, with his insignia as god of the ocean, and the spaces are filled up with an anchor and cables, &c. On the left of the centre is another female figure, attended by two boys, bearing the olive branch in her right hand, and pouring out abundance from the cornucopia with her left; and the emblems of commerce occupy the extreme angle on the left side, with casks and bales of goods.

Railway Accidents.—From an estimate made up to the end September, it appears that the number of accidents on railroads has borne but a small proportion to the amount of traffic and intercourse. On the York and North Midland Railway, the number of miles travelled being 260,476, and of passengers 125,870, there was no accident. On the Shoreham branch of the London and Brighton Railway, the number of miles run was 11,424, and passengers carried 86,576, when one man only was killed from the third class carriage; the Preston and Wyre 8,000 miles, and 50,000 passengers; Manchester and Birmingham 13,100 miles, and 214,371 passengers; London and Blackwall 20,560 miles, and 565,738 passengers; and Birmingham and Derby Junction with 167,451 passengers, no accidents, fatal or otherwise, have occurred. On the Manchester, Bolton, and Bury Railways, out of 701,599 passengers, there were but two slight accidents; and with the London and Croydon, with 136,643 miles, and 731,071 passengers, there were but four accidents, none of which were attributable to the railway. On the London and Greenwich Railway, from February 9, 1836, to June 30, 1840, the number of miles run was 570,305, and there were 5,787,240 passengers carried, without the slightest accident. On the Glasgow and Paisley Railway, in 6½ days, about 12,00 miles were run, and 117,407 passengers carried; and on the Ulster Railway, in 13½ months, 41,424 miles were run, and 426,346 persons taken, without any accident. On the Stockton and Darlington Railway, with a traffic of 320,027 passengers, but one man was injured, who soon recovered.

The Tower of London.—The new building intended as a jewel office is in rapid progress towards completion, and is contracted to be opened to the public by the 1st of next January. The smallness of the old one was very inconvenient, as not more than a dozen persons could be accommodated at one time, whereas the present is sufficiently spacious for fifty or sixty visitors to stand without inconvenience. The regalia will be placed in the centre of the room, in a kind of cage of iron-work, but it is not yet decided whether they are to be exhibited by day or candlelight, as experiments are first to be made to prove which will best exhibit the brilliancy of the jewels. The latter is adopted in the old building.

The "Oriental."—This noble steam-ship (the first on the line of the accelerated East Indian mail conveyance) arrived at Liverpool on Saturday last, having made a most successful run, performing the whole distance out and home in 36½ hours less than the contract time. We learn by her log that in her outward voyage she steamed from Falmouth to Gibraltar in 122½ hours; from Gibraltar to Malta, 111½; and from Malta to Alexandria in 95½—the whole distance (2868 nautical miles) in 13 days 17½ hours. In her homeward voyage—from Alexandria to Malta in 92½ hours; Malta to Gibraltar, 109½; Gibraltar to Falmouth, 119—whole homeward voyage 13 days 9 hours. In this vessel (built by Messrs. Wilson and Co.) the engines are by Fawcett and Co., and the furnaces furnished with Shaw's bridges, the whole forming one of the most perfect specimens of a steam-ship that has yet been brought into service.

Electrical Telegraph.—Professor Wheatstone, the inventor of the electrial telegraph, which is now at work on the Great Western Railway, is at present in Brussels, where he has been trying the new improvements he has introduced in his apparatus. Mr. Wheatstone has succeeded in so simplifying his apparatus that he has reduced the num-

ber of wires employed to two. They are covered with caoutchouc, and inclosed in tubes; the principal thing to be attended to is to protect them from wet. The great objection which had been previously made to these telegraphs was the difficulty of repairing the wires in case any should be broken or damaged, as it was supposed it would not be possible to tell where the fracture was. This difficulty has now been obviated by means of a small carriage moved along the line of the telegraph. The place where the defect lies is indicated by a magnetic needle, which changes its position the instant it arrives at the part where the connection is broken. Professor Wheatstone conceives that it is possible to communicate with his apparatus between Dovor and Calais. He has been repeating his experiments at the Brussels Observatory in the presence of many scientific men.

Colouring Marble.—The art of colouring marbles, so as to give them the richest and most beautiful tints, has been recently carried to great perfection in Italy, by M. Ciceri. A solution of nitrate of silver penetrates into the marble, and produces a deep colour. A solution of nitrate gold penetrates about the 12th part of an inch; it gives a beautiful violet-purple. A solution of verdigris gives a clear green; solutions of dragon's blood likewise penetrate marble, giving it a beautiful red. It is penetrated to a considerable thickness by all alcoholic tinctures of colouring woods, such as Brazil wood, Campeachy, &c. The alcoholic tincture of cochineal, mixed with a little alum, produces a very beautiful bright colour, which penetrates far into the marble, and makes it resemble the red marble of Africa. Orpiment dissolved in ammonia quickly dyes marble a yellow colour, which becomes more vivid the longer it is exposed to the air. The solvent which causes the colouring matters to penetrate farthest into the marble, is wax. Veridigris, which has been boiled in wax, and applied to the marble quite hot, penetrates to the extent of nearly half an inch, and produces a fine emerald.

The Origin of the Fire at Plymouth Dock-yard.—It appears that what is called a "bin" had been placed under the shed which covered the Talavera. This "bin" is an erection of wood, made for the purpose of containing the offal collected from the neighbouring parts of the yard, till it can be conveniently removed from the arsenal, and the one constructed under the shed over the Talavera was of the extent of about 400 square feet. It was placed on the south side of the ship, and at the distance of about 30 feet from her. The refuse from all the neighbouring works and offices had been thrown into it; and it contained, as we are informed, a large mass of filth, composed of oakum, tallow, waste of paint, old canvas, sawdust, chips, &c. This mass generated a high degree of heat, and spontaneous combustion was the result. The fire thus originating communicated with the shed over the Talavera; for it is now proved that the shed, not the ship, was first on fire. From the shed the Talavera was kindled, and the coal tar, with which that vessel was impregnated to saturation, generating gas in large quantities, by the heat of the burning shed operating upon it, an easy medium for communicating the flames from one part to another was thus provided, and the rapidity with which they spread from stem to stern is in this manner accounted for. This solution of the mystery appears to be perfectly satisfactory. The contents of the bin are exactly such as would give rise to spontaneous flame, and this is not the only instance of spontaneous combustion in the arsenal. Some time since, a quantity of vegetable oil having been drawn off from a cask, a portion of it was spilt upon the floor. Sawdust was thrown upon it in order to dry it up; and when this object was accomplished, it was then swept into a mass, and placed in a small cart in a position where it was exposed to the sun. The day was extremely warm, and not long after it had been exposed in this manner, a report, as if a musket had exploded, was heard, and immediately afterwards the wood, near which the cart stood, was found to be on fire, as well as the mass itself which the cart contained. A quantity of rope-yarn had once been laid untarred in a heap, and the heat which it soon generated was so great that it raised the thermometer to 180.° Those facts show that spontaneous combustion was very possible. The suspicions of incendiarism have vanished—that was nearly, if not altogether, impossible; for no fire, no light, had been in or near the Talavera for weeks, and then, to spontaneous combustion alone can we attribute the origin of the fire. But this is not all. Before the sentinel fired the musket of alarm, the fire was witnessed by a person on board the Vengeance, which ship lay at a short distance off the docks. The person who observed it fancied at first that the flame he saw proceeded from the light of a lantern, as it appeared to be moved about as if carried by some individual in the yard. Soon after his attention was drawn to this object another flame sprung up, and then a third, and immediately afterwards all the three seemed to unite in one, and to start up a considerable height towards the shed over the Talavera. This is just the way in which spontaneous flame would first have been observed under the circumstances. The heat, which gave rise to the flame in the mass of filth must have been generated, not on its surface, but in its centre, or towards the bottom of the mass, and, when it became ignited, the flame would have burst from the "bin" in different places and at different times, according as it met with obstacles in its upward progress. The carpenter of the Minden has given evidence which shows that the fire burned downwards, and his evidence has been corroborated. He states that, when he went on board the Minden after the fire broke out, he looked through the hawser holes of the ship, and there was then no appearance of fire on the gun-deck of the Talavera. Had these facts been at first known, the idea of incendiarism would have been scouted by every person.

LIST OF PATENTS.

Continued from page 216.

(SIX MONTHS FOR ENROLMENT.)

Frederick Payne Mackelcan, of Birmingham, for "certain improved throwling machinery, a portion of which may be used as a means of transmitting power to other machinery."—Sealed October 1.

Thomas Joyce, of Manchester, for "a certain article which forms or may be used as a handsome knob for parlour and other doors, bell pulls, and curtain pins, and is also capable of being used for a variety of useful and ornamental purposes in the interior of dwelling-houses and other places."—Sealed October 1.

William Henry Fox Talbot, of Lacock Abbey, Wilts, esq., for "improvements in producing or obtaining motive power."—Sealed Oct. 1.

William Horsfall, of Manchester, card maker, for "an improvement or improvements in cards for carding cotton-wool, silk, flax, and other fibrous substances."—Sealed October 1.

James Stirling, of Dundee, engineer, and Robert Stirling of Glasten, Aryshire, doctor in divinity, for "certain improvements in air engines."—Sealed October 1.

George Ritchie, of Gracechurch-street, and Edward Bowra, of the same place, manufacturers, for "improvements in the manufacture of boas, muffs, cuffs, flounces, and tippets."—Sealed October 1.

James Tilt, sen., of Wilmer Gardens, Hoxton Old Town, manufacturer, for "a novel construction of machinery for communicating mechanical power."—Sealed October 7.

John Davis, of Manchester, civil engineer, for "certain improvements in machinery or apparatus for weaving," being a communication.—Sealed October 7.

Thomas Spencer, of Liverpool, carver and gilder, and John Wilson, of the same place, lecturer on chemistry, for "certain improvements in the process of engraving on metals by means of voltaic electricity."—Sealed October 7.

Thomas Wood, the younger, of Wandsworth-road, Clapham, gentleman, for "improvements in paving streets, roads, bridges, squares, paths, and such like ways."—Sealed October 7.

Charles Payne, of South Lambeth, gentleman, for "improvements in salting animal matters."—Sealed October 13.

Robert Pettit, of Woodhouse-place, Stepney-green, gentleman, for "improvements in railroads, and in the carriages and wheels employed thereon."—Sealed October 15.

Henry George Francis, Earl of Ducie, of Woodchester Park, Gloucester, Richard Clyburn, of Uley, engineer, and Edwin Budding, of Dursley, engineer, for "certain improvements in machinery for cutting vegetable and other substances."—Sealed October 15.

William Newton, of Chancery-lane, civil engineer, for "an invention of certain improvements in engines, to be worked by air or other gases."—Sealed October 15.

James Hancock, of Sidney-square, Mile-end, civil engineer, for "an improved method of raising water and other fluids."—Sealed October 15.

Henry Pinkus, of Panton-square, esq., for "an improved method of combining and applying materials applicable to formation or construction of roads or ways."—Sealed October 15.

Charles Parker, of Darlington, flax spinner, for "improvements in looms for weaving linen and other fabrics, to be worked by hand, steam, water, or any other motive power.—Sealed October 22.

Richard Edmunds, of Banbury, gentleman, for "certain improvements in machines or apparatus for preparing and drilling land, and for depositing seeds or manure therein."—Sealed October 22.

Thomas Clark, of Wolverhampton, iron founder, for "certain improvements in the construction of locks, latches, and such like fastenings applicable to securing doors, gates, shutters, windows, and such like purposes," being a communication.—Sealed October 22.

Gabriel Riddle, of Paternoster Row, stationer, and Thomas Piper, of Bishopsgate, builder of an extension of an invention, for the term of seven years, for "a certain improvement or improvements on wheels for carriages."—Sealed October 22.